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Treatment of Paretic Neurosyphilis by Malaria and Tryparsamide*

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THE various types of treatment for general paresis divide themselves into two broad groups, (a) pyretotherapy and (b) chemotherapy. The former includes electropyrexia, malaria therapy (naturally or artificially induced), relapsing fever, rat-bite fever, as well as the use of typhoid vaccine intravenously, sulfosine intramuscularly and pyrifer (*B. coli*) intravenously. The second group—chemotherapy—includes treatment by tryparsamide intravenously, neoarsphenamine or arsphenamine intravenously, bismuth intramuscularly, mercury intramuscularly or by inunction and potassium iodide orally. This paper deals with treatment involving one member of each group, namely the use of malaria and tryparsamide.

Malaria Therapy

Malaria was first used for the treatment of general paresis in 1917 by Wagner-Jauregg of Vienna. As early as 1887, he had noticed that patients with general paresis showed definite improvement following an attack of such intercurrent infections as typhoid fever, pneumonia and erysipelas. He finally selected malaria as a fever-producing infection for which there was a definite specific, namely quinine. Wagner-Jauregg and his collaborator Gerstmann claimed remarkable results in early cases of general paresis treated by malaria. The treatment was later introduced on this continent and has been widely used since. The type of malaria preferred has been benign tertian, caused by the *Plasmodium vivax*. However, in England and in some continental clinics

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the quartan (*Plasmodium malariae*) and even the malignant tertian (*Plasmodium falciparum*) types have been used. The quartan is the mildest of the three types, the malignant tertian the severest, and the benign tertian of medium severity.

Two methods of inoculation have been practised: natural or direct inoculation by means of the anopheles mosquito which has previously fed upon a host harbouring the particular type of plasmodium to be used; and artificial or indirect inoculation, the transference of malarial blood from one patient to another.

Direct inoculation involves special laboratory facilities and has not been used very extensively on this continent. It has been used to a considerable degree, however, in England where special laboratory facilities have been supplied. Several English authorities are of the opinion that this type of inoculation is somewhat superior to indirect inoculation, the attack of malaria being less severe and the percentage of remissions higher.

Results of mosquito-bite inoculation of malaria at Manhattan State Hospital, New York, showed remissions and improvements in 75 per cent. of cases compared with 55 per cent. in blood-inoculated malaria. Naturally induced malaria gave twice as many paroxysms as blood inoculated malaria but they were less severe and better tolerated (1). The mortality rate at Manhattan was 2.3 per cent.

Boyd et al. (2) at the Florida State Hospital, using *Plasmodia vivax, malariae* and *falciparum* on one group of patients and artificially induced malaria on another group, found that the percentage of remissions and improvements did not differ materially in the two groups. The severity of the paroxysms rather than the number appeared to determine the character of the results. The remission rate, in patients under thirty years, was more favourable than at older ages. Quartan infection was found the most dependable for the production of severe paroxysms. Asymptomatic paresis, agitated types, and grandiose types gave the best results, in the order named. Malaria plus tryparsamide gave better results than tryparsamide alone. The mortality rate was 6.9 per cent.

CANADIAN PRACTICE

In Canada the procedure of choice is the indirect method with *Plasmodium vivax*. In practice 4 to 6 cc. of blood is withdrawn from a patient suffering from tertian malaria, kept fluid by diluting with 1 cc. of 1 per cent. sodium citrate solution, and then injected into the paretic patient. The blood may be injected subcutaneously, intramuscularly or intravenously. I have always used the intravenous method. Following the injection of the blood there is very often a slight rise in temperature to around 100°F. within 24 hours. This is supposed to be due to the injection of a foreign blood. In about a week or ten days, if the malaria develops, there is a rise in temperature followed by a high fever which occurs every other day or, more usually, every day. The temperature rises to 104°F., 105°F. or 106°F. and then drops to normal or

below normal after a few hours. A marked chill is often associated with the height of temperature but many patients do not complain of chill. In my experience quite a number of paroxysms of fever in inoculated malaria are not accompanied by any chill.

The number of paroxysms which the patient should be allowed to have is debatable. In the early days of malarial treatment, patients were allowed to have 14 up to 18 or even 20 rises of temperature, if their physical condition could stand it. However, it was found that in too many cases this number of paroxysms was more than the patient could bear and the death rate was rather high. Later it was recommended to limit the number of paroxysms to 8 or 10. However, workers in the Florida State Hospital have recommended recently that patients be allowed to have up to 21 paroxysms, claiming that the degree of improvement was in direct ratio to the number thereof. My experience in treating these cases in the Ontario Hospitals has been that it is very rarely possible to allow patients to have more than 14 or 15 paroxysms before it is necessary to stop the malaria. Paretic patients seem to withstand the high temperature remarkably well. Occasionally, however, they become quite delirious. The severity of the paroxysms may be modified by giving 5 grains of quinine sulphate or hydrochloride occasionally. Daily checking of the blood pressure, haemoglobin and red-cell count is carried out. A systolic blood pressure of 80 to 85 mm. Hg. is considered an indication for terminating the treatment. Likewise, evidence of very severe blood destruction is an indication for terminating it. During treatment the patient is encouraged to drink large quantities of liquids and to quench his thirst with chilled normal saline solution, to replace the sodium chloride lost in the profuse sweating.

When the patient has had as many paroxysms as advisable, the malaria is checked by giving 10 grains of quinine hydrochloride or sulphate three times a day for three or four days. Occasionally even after this amount of quinine the malaria may occur again. As a result of his experience with malaria in Egypt during the war, Dr. W. T. Connell (3) of Kingston recommends much larger doses of quinine, namely, 60 grains the first twenty-four hours, 45 grains each day for two days, 30 grains the fourth day, and 10 grains a day thereafter for four to six weeks. I have had a few cases in which quinine by mouth was apparently not adequately absorbed and in which the temperature still continued high. Such cases may be terminated by intravenous administration of quinine bihydrochloride, 5 grains dissolved in 10 or 20 cc. of normal saline solution, and given very slowly, perferably by the gravity method. Such cases may also be terminated by giving 0.45 grams of neoarsphenamine intravenously once or twice. During the period of the malaria, patients lose weight and strength rapidly, but as soon as it is terminated they start to eat ravenously and rapidly increase in weight.

The main contra-indications to the use of malaria are: acute infections, severe cardio-renal disease, active tuberculosis, severe cachexia, and advanced age. The chief complications of malarial treatment are: jaundice, cardiac

failure, hyperpyrexia, violent excitement, broncho-pneumonia, severe convulsions and splenic rupture.

TRYPARSAMIDE TREATMENT

About a week after the malaria has been checked, tryparsamide treatment is started. This consists in two grams of tryparsamide intravenously once a week. A careful ophthalmoscopic examination of the eye-grounds should be made previously to the use of tryparsamide and further examinations during the course of treatment. It is a debatable point as to whether patients showing retinal changes should receive tryparsamide or not. Stokes, of the Mayo Clinic, does not consider such retinal changes a serious contra-indication to the use of tryparsamide. A safe plan to adopt, however, is to discontinue the use of the drug temporarily in such cases. I used to give 3 grams of tryparsamide as the regular dosage, but following a report by Dr. Lewis D. Stevenson of Bellevue Hospital to the effect that this dosage was followed in a definite proportion of his cases by blindness, I have used as a maximum dosage 2 grams. In many clinics the course of tryparsamide consists of about ten to twelve treatments. I have often given twice as many, and in several cases as many as fifty consecutive doses of tryparsamide, without any apparent ill-effects. A repeated examination of the eyes, and of the urine, and the use of the Van den Bergh test, should be carried out during such prolonged tryparsamide treatment. Invariably patients gain tremendously in weight and physical condition under the tryparsamide follow-up treatment.

THE RATIONALE OF MALARIAL TREATMENT

There is considerable difference of opinion as to how malarial treatment brings about improvement. One school of thought believes that it is entirely by means of the fever, and another insists that the fever is not responsible for all the improvement. It is suggested that malaria stimulates the reticulo-endothelial system, with a resultant increase in the production of macrophages. Muehlens and Kirschbaum hold that in malaria there is a great impoverishment of the blood and that subsequent regeneration leads to a reactivation of the immunity process. It has also been suggested that the close relationship of the malarial parasite to the *Spirochaeta pallida* suggests that specific immunity reactions are renewed in the tissues of the paretic patient infected with malaria which destroys the spirochaetes and effects an arrest of the disease.

THE RESULTS OF MALARIAL AND TRYPARSAMIDE TREATMENT

Bunker (4), reporting upon 2,460 malarial-treated cases of general paresis, found that full remission occurred in 27 per cent. of cases and incomplete remission in 26 per cent. In 542 tryparsamide-treated cases remission was obtained in 35 per cent. Combined malarial and tryparsamide treatment gave

15.6 per cent. complete remissions and 21.9 per cent. incomplete remissions, but in these cases the tryparsamide treatment was not given until six months after the malarial treatment. On the basis of his reports it appeared that there was not much in the way of preference between tryparsamide and malarial treatment but, if anything, the results were somewhat better with tryparsamide. Bunker also reported that female patients generally attained a better clinical level than males. Serology under all forms of treatment gradually became negative, the cell count being first reduced, then the globulin content, and later the strength of the Wassermann and the colloidal gold reaction.

A few years ago Dr. G. W. Kirby of the New York Psychiatric Institute made a careful investigation of a large number of cases of general paresis treated by malaria alone and another group treated by means of tryparsamide alone. His conclusion was that malaria alone seemed to produce a slightly higher percentage of remissions than tryparsamide alone. Kirby also stated that malaria seemed to give better results with men and tryparsamide with women.

The suggestion was soon made that the two methods of treatment should be combined and courses of tryparsamide be given following malarial treatment. This is the practice now generally recommended. It is seldom that malarial treatment alone is given and most of the results quoted now are based on the combined treatment. Levin, of the Buffalo State Hospital, quoted statistics to show that the results with malaria and one or two courses of tryparsamide were little better than with malaria alone. He also reported that malaria followed by a minimum of 30 or 40 injections of tryparsamide produced much better results than malaria alone.

Kusch, an American worker, recently pointed out that when arteriosclerosis and alcoholism were present in general paretics, the outlook was distinctly less favourable. Most reports divide results into good remissions, marked improvement, slight improvement and no improvement. Good remissions include patients who have improved to such an extent that they can be discharged from the hospital and maintain themselves either completely or to a very large extent. Improved patients are those who have improved materially and in whom the disease has been checked, but who have already suffered from such brain damage that they are unable to be discharged from the hospital except under very favourable conditions. Slight improvement means that patients are much improved physically and are much easier to look after.

The types of general paresis which seem to be most benefited by treatment are the grandiose and simple dementing types. Bunker places the type in order of improvement as follows: (1) expansive type, (2) manic type, (3) simple dementing type, and (4) schizophrenic type. I have noticed no difference in the relative percentage of recoveries in male and female patients but some observers do report a higher percentage of recoveries in females than in males. Some reported results of treatment are as follows:

Investigator	*Good Remission*	*Improvement*
Askgaard	36.6%	26%
Nonne	10.8%	24.3%
Lewis	31%	—
Grant and Sylvester	26.2%	—
Caldwell (597 cases)	29.7%	13.9%
Kirschbaum (196 cases)	31%	21%
Kirby (156 cases)	33%	17%
Gerstmann (400 cases)	33%	14.25%
Leroy et al. (102 cases)	36%	12%
Carlson (209 cases)	(48.6%)	
Kasche (363 cases)	(55%)	
Wile & Hand	(53%)	
Freeman et al. (195 cases)	31%	39%
Schiller (722 cases)	(40%)	

In twenty-six cases treated at the Ontario Hospital, Kingston, in the last four years we have obtained good remissions in seven and definite improvement in nine. Nine were unimproved and one died. This would give a remission rate of 27 per cent. and a further improvement rate of 34 per cent. Many of the patients treated were in a rather advanced stage of the disease.

In all of the aforementioned hospital-treated cases of general paresis, no attempt was made to select only the most favourable for treatment. The only criterion for malarial treatment was the physical condition of the patient. As in all other illnesses, the shorter the duration of the illness, the better the chances of improvement by malaria and tryparsamide. On the basis of general experience it would appear that, taking early *and* advanced cases as treated in mental hospitals, a remission rate of at least 30 per cent. can be anticipated and another 25 to 30 per cent. will be improved to such an extent that while they cannot be discharged from hospital they will be among the best workers.

The mortality rate is in general fairly low. Figures from various State hospitals run from 3.3. per cent. to 8.9 per cent., depending largely upon the type of plasmodium used and the physical condition of the patients treated. It has been found that patients who are in too weakened a condition to stand malarial treatment can be safely treated with typhoid vaccine intravenously, sulfosine intramuscularly, or pyrifer intravenously. Any one of these three treatments may be given at first, and then when the patient's physical condition has improved, malaria and tryparsamide may be given. Mortality rates with typhoid vaccine, sulfosine, and pyrifer are very low.

An English survey by Reid (5) showed that six to nine years following therapy 12 per cent. of all patients who had been discharged after malarial therapy were still recovered and at home. From one to five years after therapy, 24 per cent. were recovered and at home, and within one year 31 per cent. were apparently recovered and discharged home. These figures suggest that complete remission only occurs in a comparatively small percentage of cases. Carefully controlled statistics further indicate that the percentage of *permanent* remissions is apparently higher with malaria and tryparsamide therapy than with any other method of treatment.

In a recent publication from the Elgin State Hospital, Illinois, with a population of 4,500 patients, Schiller(6) states: "We have tried several methods of fever therapy at Elgin and our treatment of choice is still malaria and tryparsamide. Our second choice is typhoid vaccine and our third choice is sulfosine." Another large American mental hospital, St. Elizabeth's at Washington, D.C., after experimenting with various methods of fever therapy has returned to malaria and tryparsamide as the treatment of choice.

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Child Care in Wartime*

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THE child is the best and most lasting asset of the State and undernutrition or defects either in time of peace or war are unfortunate. As for the latter, we must remember that children form the great second line of defence in case of future trouble.

Child care during war should not differ from that during peacetime, provided thorough work was being done; there is, however, the greater urge during an emergency which often reveals palpable defects in our systematic care of children. The child has always been the ward of the State and a government must assume this care not only during peace but more especially in time of conflict.

During the last 25 years great progress has been made in child care in all civilized communities where special efforts were put forth. For instance, in Toronto in 1914 the infant mortality was 155 per 1000 births and at the end of 1938—49 per 1000 births. This is only an example of what has been and is being done in enlightened communities.

How important it is that this work not only be continued, but improved may be gleaned from these striking facts:

In estimating the loss to Europe on account of the lower birth rate in consequence of the last war, it must be borne in mind that as a regular phenomenon birth rates are decreasing all over the world. The calculation of the decrease caused particularly by the war must consequently be made very carefully. It seems justifiable, however, to assume that Great Britain and Ireland in this way lost 600,000 who would have been born if no war had taken place; France over a million and Italy 1.3 million (1). These three nations thus lost 3 million. For Germany the loss is 2.9 million. Bearing in mind that the effect may have been just as great in several other belligerent nations, such as Russia and the Balkans, we may be justified in assuming for Europe a deficit of many millions of births, and even after making a proper deduction for infant mortality, the loss has been about equal to those lost on the battlefield.

The factors that determine the population of any country are: 1, the number of children born; 2, the number of people that die; 3, the number of people that go out of or come into it. Therefore to prevent a decrease in population and to maintain an increase—the goal of every nation—it is necessary to have a high birth rate and a low death rate and to successfully encourage desirable immigration (2).

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All these problems have received serious consideration in the past. Through increased governmental activity and more especially through the establishment of many voluntary welfare agencies, the nations have been endeavouring to compensate for the lowered birth rate by saving the lives of babies under one year of age—a period of life in which the death rate is high and in which the diseases causing the death rate are largely preventable.

To quote Hamill (2):

"At the beginning of the last great war, as would be expected, the interests of the people and their governments were centered on problems that were directly connected with the development and maintenance of their armies. The result was that the problems of civil life were neglected. The welfare agencies, that were dependent for their existence upon the voluntary effort and contribution of the people, lost both their workers and their finances. The contribution to war loans, the maintenance and carrying out of the work of institutions, such as the Red Cross, left the ordinary private agencies of civil life stranded. The withdrawal of physicians and nurses trained and working on public health problems handicapped the activities of governmental institutions. Some private agencies discontinued their work, all of them curtailed their activities, and the governmental departments became less efficient. As a result sickness and death among infants and children increased by leaps and bounds. This experience was common to all belligerent countries."

In short, the various nations found themselves facing the solution of these problems: 1, a decreased birth rate; 2, an increasing death rate; 3, an appalling destruction of adult life on the battlefield; 4, a great maiming of men, thousands of whom were totally incapacitated. What was to be done?

There was but one possible way of stemming the tide of destruction and that was by reducing the infant and child mortality and morbidity, as it was manifestly impossible to control the destruction on the battlefield. To this end governments bent their energies with some measure of success.

By what procedures were these successes brought about?

The basis of all health work is education. England at this time was able to reduce her infant death rate from 110 per thousand to 91 in a single year. The government financed every private agency of standing and multiplied her health visitors so that one was provided for every 500 children born.

Before it is too late, let us learn from our Allies the lesson of the importance of the child (3). Sir George Newman, formerly general medical officer of health for Great Britain, stated that as a general procedure it may be said that "a state cannot effectually insure itself against disease unless it begins with its children," and as a result of his experience during the years 1915-18, he outlines the necessity of the care of the child in a manner that we may well follow:

"The European war has given new emphasis to the importance of the child as a primary national asset. The future and strength of the nation unquestionably depend upon the vitality of the child, upon its health and its development and upon its education and equipment for citizenship. Great and far-reaching issues have their origin and some of their inspiration in him. Yet in a certain narrow sense everything depends upon his physique. If that

be sound, we have a rock upon which a nation and a race may be built; if that be impaired, we lack that foundation and build upon the sand. It would be difficult to overestimate the volume of inefficiency, of unfitness and suffering, of unnecessary expenditure, and of industrial unrest and unemployment to which this country consents because of its failure to rear and educate a healthy, virile and well-equipped race of children and young people. There is no investment comparable to this, no national economy so fundamental; there is also no waste so irretrievable as that of a nation which is careless of its rising generation. And the goal is not an industrial machine, a technical workman, a 'hand' available merely for the increase of material output and the acquisition of a wage at the earliest moment, but a human personality, well grown and ready in body and mind, able to work, able to play, a good citizen, the healthy parent of a future generation. If these things be true, and I believe they are, no reconstruction of the state can wisely ignore the claims of the child."

Food is essential to the growing child (3). If adults must restrict their diet, let them do so as a war necessity. For the child there should be no restriction. If it is impossible, and it certainly is impracticable, to make any widespread changes in the home conditions and readjust all of the social and economic factors that have resulted in this problem, it is not an insurmountable difficulty to meet the problem, if we act from the community point of view. Two methods are open for immediate action. Firstly, community centres may be established where mothers may be taught how to adjust the family income to the food needs of the growing child, and just what foods to buy. Classes should be held in simple cooking, and lessons given in regard to well-balanced diets which meet the needs of the children. Secondly, the community may come into more direct contact with the child by the establishment of canteens for children, or by providing school lunches, where an adequate well-balanced meal each day for each child in the community can be served. These lunches or canteens should not be a charity. Each meal should be paid for by the child if possible, but meals should be given freely when necessary.

In establishing work of this kind, it is realized that communities are very slow to take the initiative and it is probable that private organization will have to do the work in many places before the State can be made to realize its own obligation. As rapidly as possible, however, this feeding of the children should become the function of the government. This work should not be confined to our large cities. If the canteen is impracticable in small towns, instructions in regard to home feeding of children can usually be carried out with little difficulty. The work of conserving the health of our children should be universal. It is war work of the first importance.

Putting aside all humanitarian impulses, if it is possible, and viewing the matter from the coldly practical point of view, there can be no question that the matter of combating this condition of undernourishment of children is an immediate duty of our country; it is a war measure second in importance only to the fighting itself. In fact our children, as stated before, may be considered literally as our second line of defence. To let anything seriously

interfere with their health and development is criminal neglect. In a few years from now it will be too late to repair the damage. At the present time we can do something toward correcting the serious condition that already prevails and we can surely prevent additional cases from occurring in the future. The question of the health supervision of children should assume in this country a position second only to the fighting forces. We are fighting to make the world safe for democracy, we must also fight to make our children fit to perpetuate this democracy, when it shall have been attained.

Paediatrics has led the way in preventive medicine. I am sure it is not necessary to tell you that most diseases of children are largely preventable if the public will only avail themselves of the opportunities that exist or that the governments make available. For years the Hospital for Sick Children, Toronto, has directed its research along the lines of prevention and I am glad to say it has been crowned with success—such diseases as intestinal intoxication, dysentery, deficiency diseases, are all preventable. Diphtheria, smallpox, whooping cough, are preventable through vaccination and active immunization, while measles may be modified and in some cases prevented.

The most important conditions, however, are malnutrition and secondary anaemias which predispose the individual to all other diseases. One never sees a death from a nutritional disturbance now in private practice because the people of the intelligent class know the value of health supervision. This remark should be made to apply to all of our Canadian children.

To quote from an address by Tisdall (4):

"Are all the people of Canada obtaining food which comes up to the Canadian Dietary Standard? In other words, food adequate for health? The answer is most decidedly no. For instance, there has just been completed in Toronto, by the Toronto Committee for Dietary Studies, a study of the food consumption of 100 families in the lower income group. A preliminary report by McHenry shows rather striking deficiencies. Only 3 families out of the 100 secured the caloric supply recommended by the Canadian Dietary Standard. The average protein intake for all the families was 77 per cent. of the standard, and only 7 per cent. of the families had protein intake above the standard. The amounts of calcium secured by children in these families was distressingly low, averaging 57 per cent. of the standard for young children and 49 per cent. for older children. Women need iron in more generous amounts than do men but the women in these families received only an average of 53 per cent. of the standard. This is sufficient evidence for you to realize that malnutrition is an important problem to us in Canada."

There are two factors involved. One is the lack of knowledge of what constitutes proper nutrition, and in this regard I should like to compliment the Committee on Nutrition of the Canadian Medical Association of whom F. F. Tisdall, Director of Research at the Hospital for Sick Children, is the able chairman. Through his efforts the Canadian Life Insurance Officers Association has distributed over a million copies of a booklet entitled "What to Eat to be Healthy". Posters on what to eat to be healthy will be tried out in some of the schools in Ontario. In this regard it should be kept in the mind that our great field of endeavour should be with children, because in

spite of anything that is said, it is extremely difficult to change your eating habits and mine.

"The other great problem is to make the protective foods, namely milk, meat, eggs, vegetables and fruit, available to the poorer classes at a price at which they can afford to buy them. In other words, there is no use our trying to educate the people to feed their children a pint to a pint and a half of milk a day, an egg a day, some meat, two vegetables besides potatoes, and some fruit, with cod liver oil in the winter months, unless the price of these foods is within reach of their purchasing power" (4).

The importance of nutrition cannot be better expressed than in the words of Dr. James S. McLester in his presidential address at the joint meeting of the Canadian and American Medical Associations in 1935: "In the future, science promises to those races who will take advantage of the newer knowledge of nutrition, a larger stature, greater vigor, increased longevity, and a higher level of cultural attainment. To a measurable degree, man is now master of his own destiny where once he was subject only to the grim hand of fate."

From what has been said, I think it is reasonably clear what our attitude should be:

(1) Voluntary organizations should be encouraged to carry on and if necessary their funds should be augmented by government grants.

(2) No new institutions should be constructed or opened as those already existing are able to carry on and if necessary their personnel may be increased as the work enlarges.

(3) Greater emphasis should be laid on the importance of child nutrition through education in homes, schools, newspapers, magazines and radio.

(4) There should be no increase in the price of the essential foods, or of sera, vaccines, and other necessities.

(5) More intensive research is essential. If necessary, money should be appropriated by the government for this purpose.

"It becomes our duty as citizens, just as great a duty as that we owe to any of the activities directly connected with the creation and maintenance of our armies, to give of our time and our money to the institutions that have been and will be created for the protection of the lives of our children. Let us not add to the results of battle the casualties that will inevitably follow the neglect of these little ones. Canada is now calling to her citizens to see to it that her people are protected in such a way as to make it possible for them to give the best that is in them to the work they are doing so that the highest efficiency at home may contribute to the efficiency of her armies abroad" (2).

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Industrial Medical Service in Peace and War

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INDUSTRIAL medicine to-day has as its object adequate care of the health of the industrial worker. In practice this is applied through industry. It differs from ordinary medical practice in that it affords an opportunity to apply preventive medical measures and to disseminate health information to a large section of the adult population. Although we are all familiar with the health work carried on in schools, few of us realize that such supervision ceases when the youth of the country reach a productive age, that is, when they start to repay society for the money expended on them.

An industrial medical service has two main functions, the treatment of accidents and diseases, and medical supervision of the industrial personnel.

The Treatment of Diseases and Accidents

With the adoption of Workmen's Compensation laws some twenty-five or thirty years ago, the problem of the economic cost of accidents together with the consequent disability and lost time was suddenly presented to industry. As a result, many employers made arrangements to meet the situation, and accident prevention, as we know it to-day, was born. At the same time definite schemes were worked out to provide medical attention for injured workmen with the minimum of delay. The simplest one was the practice of listing the telephone numbers of local physicians in order that a physician might be quickly obtained when an emergency arose. To-day this scheme is still the only arrangement in many plants.

The benefits to be derived from a system of accident prevention soon became apparent and many employers then instituted more extensive facilities to treat accident cases. This practice proved economically advantageous to both worker and employer. During this stage, provision for first-aid in industry made rapid strides and the value of adequate early treatment of even minor injuries was soon recognized.

Such arrangements brought employer and physician closer together. As a result, attention was directed to the economic aspects of ordinary sickness for which an employer had no direct responsibility but which, through disorganization of production, cost him money. This problem led some employers to make arrangements for the care of sick employees. In some instances a small monthly charge was made which provided for similar benefits to their families. Certain schemes developed to an extent where the employer erected a hospital and invested money in expensive equipment. In many cases this created an

economic condition that threatened the company's medical service. Newquist, in a communication on medical service in industry, reports three large companies operating their own hospitals at a patient cost of from ten dollars to twenty dollars a day, while the local community hospital costs were from four dollars to seven dollars a day. Obviously such discrepancies in costs are not sound and hinder rather than advance industrial medicine.

It is not my intention to discuss in detail the treatment aspects of industrial medicine. The following points, however, should be noted: (1) The treatment of accidental injury was the prime, if not the only consideration in the earlier medical arrangements and it was for this purpose that industry and medicine were first brought together. (2) The best industrial medical arrangement for the treatment of accidents or disease is an individual problem for each company. (3) The use of local facilities for treatment purposes will usually provide the most adequate care for the least cost if suitable arrangements are made.

MEDICAL SUPERVISION OF INDUSTRIAL PERSONNEL

The second function of an industrial medical service, medical supervision of employees, has for its aim the promotion of the health and happiness of the worker. When properly applied it extends the life and increases the output of the average worker and reduces the cost of medical care. It has advantages for both state and industry as well as for the individual. When improperly applied it creates a hardship for the worker, puts an increased burden on the state, and causes social discord.

Medical supervision of workers may be applied through any agency that can arrange to bring groups of workers together and to provide the necessary financial support. It can be done by the state in a manner similar to that of the medical supervision of school children, by private organizations such as labour, or by industry either as individual units or collectively.

In my opinion, medical supervision of workers, under ordinary conditions, is best effected through industry. If undertaken by other agencies the plan might be too general and lack flexibility to suit the individual industry. It would have a tendency to deal with the problem from an adult health viewpoint only and to neglect such important considerations as environmental influences, placing of employees, supervision of treatment, control of industrial diseases, and many other factors. The physician's contact with industry would be very indirect and any co-operative scheme between medicine and industry would be seriously embarrassed by a lack of understanding of each other's problems.

It is the type of industrial medical service which is operated through and with the co-operation of industry that I wish to discuss. There are three parties who are directly affected by any industrial medical service, namely the employee, the company, and the doctor. If a satisfactory method of supervision is to be maintained it is essential that there be reasonable co-operation among these three.

In practice an employer selects the physician who is to be in charge of the work. He has also to decide whether a full-time doctor or a part-time one will be engaged. In large plants a full-time doctor may be necessary but even here, if adequate assistance is provided, excellent results can be obtained by a part-time physician. The employer is not in a position to evaluate the physician's medical competence but he should come to some conclusion regarding the doctor as a man. A physician, apart from his medical training, needs to be tactful, firm though sympathetic, and co-operative. In addition, he should have a manner that inspires confidence, and a reputation for fair and honest dealing. It is also necessary that he be the type of individual who will study conditions in a plant and will familiarize himself with the special services required.

It is obvious that the director of the medical service should have a medical education and a licence to practise his profession in the country where he works. While this is an essential requirement it is by no means the only one. The successful industrial physician must be interested in preventive medicine. The doctors who have special training in this subject or who are interested in social conditions in their community are more likely to be satisfactory industrial physicians than those who confine their interests to the treatment of disease. A physician who is continuously at variance with his fellow practitioners is seldom satisfactory in industrial medical service.

The place occupied by the doctor in the organization is of great importance. Should he be placed in the same position as an ordinary employee he will lose not only professional standing in the eyes of the worker but also the worker's respect, confidence, and trust. In order that any system of medical supervision may be satisfactory, the physician-in-charge must work directly with the head or director of the company. The absence of such an arrangement is often the reason why a full-time physician fails, where a part-time one succeeds. The latter is in a better position to resist attempts to subordinate his work in the organization.

When the physician has been selected, a definite program of medical service should be arranged. In formulating this plan the company and the physician should collaborate. Information concerning other successful medical services in operation should be carefully considered. It is also advisable to consult persons with special training in industrial medicine for suggestions regarding the type of service best suited for that particular industry.

THE FUNDAMENTALS OF A MEDICAL SERVICE PLAN

The plan of any medical service will vary according to the individual requirements of the industry concerned. In practice the following four points should be carefully considered before any plan is adopted: the location of the industry; the number of employees; the nature of materials used and the environmental conditions in the factory; periodical medical examination.

If the industry is located away from centres of population, arrangements for medical treatment and hospital care may be necessary. Such a company

may find it necessary to have its own hospital or to help finance local hospitals and may even have to provide facilities for the care of its workers' dependents. These conditions, however, are usually found only in industries which develop the natural resources of the country. Industries in populated sections do not require such elaborate facilities.

The number of employees in a plant will naturally have some bearing on whether a full-time or a part-time physician will be used. It will also definitely limit the amount of money available for medical service and supervision. While it is difficult to give definite figures applicable to all industries, Brundage considers that an employer can afford to spend $12,000 per year per 1000 employees for preventing accidents and conserving health, when his accident and occupational disease rate is considerably below the average experience. Where health and accident hazards are more than average, a larger expenditure for health and safety work may be advisable. Many satisfactory services have been inaugurated with expenditures of only five or six dollars per worker per year and increased as the need and results of health supervision became more apparent to those paying the cost. A medical service based on humanitarian ideals at the expense of the economic considerations cannot be permanent. It will eventually harm rather than help the problem. Small industries which are advantageously located can often group together and have a common medical service of a higher calibre than would otherwise be possible.

The nature of the materials used and the environmental conditions in a plant are of extreme importance when its medical service program is being arranged. Moreover, such factors greatly influence the type of service which is required. If dangerous materials such as lead, silica, benzol, toxic solvents, etc., are used, the type of supervision adopted must provide special examination of those workers who handle such substances. Examinations of this type would detect early any trouble that might occur and prevent the worker from being seriously affected by the materials he is using. Furthermore, they would indicate the environmental conditions in the plant that require further correction.

The plan adopted for medical supervision must include periodical medical examination. Each worker should be examined when first employed and at stated intervals afterwards. Careful records should be kept in order that any change in his condition may be noted. Such records should be private, available only to the physician or his assistants. It is not only decidedly unfair but it is unethical that the physician's detailed reports be made available to every enquiring officer of the company. Should workers realize that records of their examinations are public property they, naturally rightly, object to the examinations. Without the co-operation of the employees, any form of periodical medical examination is greatly handicapped, as information volunteered by a patient constitutes fifty per cent. of the value of an examination. A company is entitled to know whether a workman is in a suitable physical condition for his work and the physician is justified in asking the company to remove a worker who is suffering from a disease that might endanger his fellow workers.

It is important that all people employed in the company from the head to the most humble worker be included in these examinations. Health is no respector of persons. Independent of station in life, all benefit equally by preventive measures. Should supervision stop at the factory door, excluding both office staff and senior officials, it would be very difficult to explain its benefits to workmen. Such limitation would make the workmen suspicious that these examinations were not in their best interests. It would also create a class consciousness with its inherent bad feeling. A situation like this antagonizes workmen in much the same manner as an office official does by smoking in the factory when the workmen are denied the privilege owing to danger from fire. Workmen look to their employers for leadership but leadership must be earned by the employer. It is obvious that the more important the company official, the more interest should a company take in his health. There have been many instances where a business has been ruined because its head became mentally or physically unfit for his position. His ailment was brought to light only by the disintegration of the business. This is a costly and unnecessary way to detect illness.

Placing men who have physical defects which have been detected by medical supervision, constitutes an individual problem for each plant. It depends on a consideration of the work requirements of each job in relation to the man in question. It must be remembered that few people are perfect in all respects. As age progresses, physical and mental defects increase. However, too much reliance need not be placed on age as a barrier to work. Naturally few people at 80 are in physical condition to be valuable to industry but there are plenty well over 60 years of age who can hold their own with any newcomer in their respective positions.

As we get older there is one compensating factor that we all practise with increasing intensity. It is to husband our physical resources for the work which we have to do. By so doing we may, as the years go by, either maintain a uniform output or actually increase it. There are certain positions in which older workmen are decidedly better risks than young men. There are many people in all age groups who have defects which make them more prone to sudden death than the average man. Such people should not be denied work because of their probable failure. However, they should not be given positions in which their failure would endanger the lives of other people.

In most industries minor defects are not a barrier to any position. There are, however, certain occupations such as aeroplane transport where they might constitute legitimate reasons for excluding a worker. A major defect is important only when the work requirements aggravate it, thereby increasing the risk to the worker concerned. Hernia becomes an important major defect when a worker thus afflicted is required to do heavy manual labour. When only sedentary work is required, the presence of hernia, although still a major defect, is not an important consideration.

THE VALUE OF MEDICAL SUPERVISION OF INDUSTRIAL PERSONNEL

Although at the present time we are not in a position to state the ultimate value of medical supervision of large groups of adult workers conducted over a long period of time, we can speculate on the possible advantages.

From a medical viewpoint people can be divided into two groups, those who are sick and those who apparently are well. The latter group can itself be divided into two—those who are well, and those who only think they are in good health. From the last group come the sick people of to-morrow. Heart disease, cancer, pneumonia, chronic nephritis, accidents, cerebral haemorrhage, and tuberculosis are, in the order named, the most common causes of death to-day. With the exception of pneumonia and accidents, these are usually caused by chronic conditions of long standing. When a man dies suddenly from heart disease it does not indicate that he was suffering from an acute condition; rather it is but the abrupt ending of a chronic ailment. The importance of cancer as a cause of death is appreciated by all, but many people only realize its presence when the disease is well advanced. High blood pressure may first make its presence known by brain haemorrhage. Tuberculosis is an insidious disease. Often its presence is not recognized and in early stages it is frequently mistaken for a chronic cold. It is responsible for many deaths between the ages of 20-40.

Early recognition of the conditions underlying these diseases can be established only by periodic medical examination. When the condition is recognized early, cure or modification with extension of life can be obtained in most cases. Under medical supervision a worker has this valuable protection against the most common diseases which cause death.

Newquist states that a loss of approximately one-half day per worker per year is caused by industrial accidents and that lost time from sickness for which the employer is not responsible is fifteen times this figure. He estimates that, at five dollars per day, lost time from sickness costs the industrial workers of the United States a sum of $2,000,000,000 per year. It has been shown that organized industrial medical service can reduce lost time due to accidents 22 per cent. below that for injuries treated under unorganized services. If the same decrease of lost time from sickness could be effected, a sum of $400,000,000 per year would be saved. Respiratory diseases, which include the common cold, are still the greatest cause of absenteeism in industry, accounting for about 40 per cent. of the total. Digestive diseases rank second, causing 14 per cent. of the lost time. It is evident that the diseases which cause the industrial worker the most lost time from sickness are, as a general rule, not serious enough to make him seek medical treatment unless this is drawn to his attention through health supervision.

Lost time due to industrial diseases accounts for ½-2 per cent. of all disabilities from industrial causes. While this is not a large part of the total amount, it is nevertheless exceedingly important in those industries in which it does occur. It must be remembered that the chief difference between an occupational disease and an ordinary illness is that the former is artificial, being produced by man-made conditions, while the latter is not always avoid-

able. The symptoms in the two may be the same. Generally speaking, occupational diseases present similar symptoms to those of other diseases. They are readily recognized only by the occupational history and by the use of special tests and methods of examination directed to the materials used by the worker.

Many plants have medical supervision only because dangerous materials are being processed. Very often such processes cannot be made entirely safe because of the small quantity of offending materials that will cause trouble over a period of time. In most cases the trouble is caused by breathing the dangerous material in the form of dust or vapour. The illness produced is chronic in nature and only specialized medical supervision can determine that the worker is being affected before serious damage is done.

The type of medical supervision required where dangerous materials are used will naturally be directed toward the dangerous substances as well as toward the general health of the worker. Where a lead hazard is present, blood examinations are required at stated intervals to detect the amount of lead absorption. Where benzol is the hazard special blood tests are indicated. Workers exposed to silica dust should be X-rayed periodically and examined carefully for the presence of tuberculosis. In every case, medical supervision of workers exposed to dangerous materials requires a special type of examination, its nature depending on the substances used. The physician doing the examination must familiarize himself with these special requirements as they are not often used in ordinary practice.

Probably the greatest benefit of medical supervision is not to the worker or to industry, but to mankind at large. Progress in medical science depends on opportunity. Medical supervision provides an opportunity to study the health of large groups of people year after year. From such studies much could be learned. The earliest stages of such diseases as cancer, tuberculosis, and heart trouble could be ascertained and it might become possible to recognize the underlying condition of our common ailments. Too much information cannot be obtained on the origin of disease if prevention or effective cure is to be attained. Only by studying people in good health can we hope to recognize disease at its earliest inception.

One of the difficulties in medical science is to explain why certain people contract disease, while others escape. This is true of occupational disease as well as of the ordinary ailments of life. We say of such people that they are "susceptible" to the disease in question. In some cases we can determine this susceptibility beforehand. Unfortunately, however, in most instances it is only after a person has developed a disease that we know he was susceptible, in much the same manner as we say that a worker is careless after he has had an accident. Medical supervision of groups permits the study of this question of susceptibility. For instance, not all workers exposed to silica dust develop silicosis. Careful study of those who do not develop this disease might in time make it possible to select workers for this type of work who are not readily susceptible to silica dust. If we could find out why silicotics are so prone to tuberculosis we might have the answer to the whole problem of tuberculosis.

Twenty years ago the volatile solvents used in industry could be counted on the fingers of one hand. To-day they number some three hundred or more. Although studies are made to determine the toxicity of these materials before use, they cannot indicate the effect on the health of the worker of a small exposure for a long period of time. This can only be ascertained by the periodical examination of the exposed workers.

It may be possible that some of the new chemicals introduced into industry will influence health favourably in respect to certain diseases. We should be just as interested in finding out why the workers in one industry have a favourable health experience as we are in trying to locate the reasons for a poor health record.

To-day, progressive employers are wondering why their success in reducing lost time from accidents cannot be duplicated in regard to sickness. This naturally turns their attention to medical supervision.

During the next few years medical supervision in industry will expand and will supplant in importance the treatment aspects of industrial medical service. Such a trend will be greatly influenced by the present conflict, as the problems of industry during a national emergency, such as the present war, are greatly increased and the need for medical supervision is made more obvious.

INDUSTRIAL AND MEDICAL SERVICE IN TIME OF WAR

In peace time "costs" dominate industry, as the ability to manufacture usually exceeds the requirements at standard competitive prices. During a modern war the production of vital supplies is the prime consideration of industry. All other factors are of secondary importance. At such time industry has to adjust itself to a diminishing supply of labour and supervising personnel. For this reason industrial relations are of increasing importance. Many industries are expanded and others are formed in order to cope with the demand for production. Such expansion is naturally temporary and many plants and much equipment that would be considered unsatisfactory under ordinary circumstances are pressed into use.

The problem of the industrial workers is increased. Many have to work at jobs to which they are not accustomed or for which they are physically or mentally unfitted. Some have to move to new districts. Others have to make long trips to and from work. The hazard of accidents and the risk of contracting industrial disease are increased, as well as ordinary illness which is in part affected by the strain of adjustment to the new working conditions.

Under war conditions the importance of labour in production is greatly increased. When raw materials are available, labour is the limiting factor in production. For this reason during a national emergency every effort should be made to maintain labour in a high state of efficiency and to prevent impairment of effort by conditions over which the workers have no control. Such factors as hours of labour, sickness and accidents, placing of workers, plant conditions, and conditions outside the plant affecting health, become of increasing importance.

It is a fallacy to assume that long working hours will increase production.

During the last war it was found by investigation that long working hours reduced production per worker. The general provisions regarding hours of labour in the British Factory Act were shown to be sound. The more valuable the worker the more important that he be not fatigued by long working hours. Holiday breaks are important as well as the Sabbath rest. Fatigue is a nervous phenomenon and is not under voluntary control of the worker but is indirectly caused by the conditions of work.

In ordinary circumstances employers are more interested in lost time from accidents since they are responsible for these under the Workmen's Compensation Act. In a national emergency, however, lost time from ordinary sickness assumes major importance because it is fifteen times greater than that from accidents. Long hours, no holidays, etc., are definite factors increasing lost time which sometimes is ascribed to sickness.

The placing of workers within their physical capabilities is increased in importance in time of war because many workers are unfamiliar with the work requirements. The use of older and less physically fit males, together with the increase in the use of female personnel, makes the placing of workers very important. Proper placing of a worker can be done only by determining his physical condition through medical examination.

The problems in ventilation, safety, and the control of dust and fumes must be considered with due reference to the conditions presented by the emergency. War work is of a temporary nature. For this reason control of conditions, especially those affecting health, may frequently be accomplished with better results by medical supervision than by making extensive changes in the plant. Plants handling dangerous materials require medical supervision in peace as well as in war time.

Conditions outside the plant are changed for many workers. Some have to change their residence in order to be near their work. Such a condition may create a housing problem in affected areas. Housing accommodation for workers is just as much a problem as suitable equipment, if continuous production is to be considered. Nutrition is apt to be neglected because many workers, especially women, try to work as well as keep house. A noon-day meal supplied to workers insures one good meal a day and in some cases might be considered a definite responsibility of the factory management.

War conditions throw a strain on the industrial population which, if not controlled, will ultimately interfere with health and adversely influence production. It is not likely that all manufacturers can cope with the new situation and some direction is imperative if the health and productivity of the industrial population is to be maintained through a long conflict. Much credit, however, must be given to those farseeing industrial executives who have shown leadership in safeguarding the health and happiness of their workers.

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The Prevalence of Venereal Disease Infections in Vancouver

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THE Greater Vancouver Health League, working in co-operation with the Division of Venereal Disease Control, has made considerable progress in an educational way in the control of venereal disease in Vancouver, but it had been handicapped in previous years by the absence of any reliable statistics as to the prevalence of syphilis and gonorrhea in the community. Various estimates had been offered, ranging from the statement that one in seven of the population were infected to other statements that the diseases were of negligible importance, and the result had been a confusion in the public mind which made educational work difficult.

It was felt, therefore, that a survey of prevalence was justified and would serve a useful purpose. The Board of Directors of the Health League authorized the study in December and the following committee was appointed to conduct it: Dr. A. M. Menzies, unit director of the Metropolitan Health Board, chairman; Dr. A. M. Agnew, president of the Vancouver Medical Association; Dr. M. W. Thomas, executive secretary of the British Columbia Medical Association; Dr. W. W. Simpson, and the authors.

The procedure followed was similar to that of comparable surveys conducted by the Health League of Canada in Toronto in 1929 and 1937.[1,2] The object was to learn the number of cases of venereal disease which were under treatment on any one day, in this case, on December 31, 1939. Since the enquiry was limited to practising physicians, hospitals, and clinics, the results show only such cases as were under medical supervision and, therefore, fall short of indicating the total of all cases of venereal disease on the given date.

A confidential printed form and a covering letter were sent to each of 338 practising physicians in Vancouver City. The outlying suburbs usually included in Greater Vancouver were omitted. Within three weeks, 193 doctors had responded and a second letter and form were sent to the others. Later it was necessary to send a third letter and, in the case of a few men, to follow this with telephone calls.

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[1]Fenwick, C. P.: Venereal Disease Survey in Toronto, Canad. Pub. Health J., 1930, *21*:132.

[2]Bates, Gordon: A Survey of the Incidence of Venereal Diseases in Toronto in 1937, Ibid., 1938, *29*:575.

The co-operation of the medical profession was generous and excellent. Of 338 names on the list, only 13 were not accounted for, so that 96 per cent. of returns were made. Additional returns were obtained from the Vancouver Clinic of the Division of Venereal Disease Control, the Division of Tuberculosis Control, the Provincial Mental Hospitals, the Marpole Infirmary, and similar institutions.

In these circumstances, a total of 2054 cases of venereal disease in Vancouver was reported. This represents an incidence of 7.75 per thousand of the population. The total was divided into 1549 cases of syphilis (5.84 per thousand) and 483 cases of gonorrhea (1.83 per thousand), plus twenty-one additional cases which were not classified.

Private physicians (96 per cent. of the profession) reported a total of 782 cases of venereal disease, of which 528 were syphilis and 254 were gonorrhea, as shown in table I.

TABLE I

CASES OF VENEREAL DISEASE REPORTED BY PRIVATE PHYSICIANS

SYPHILIS

Total Syphilis	Early Syphilis				Late Syphilis				Not Classified
	Male		Female		Male		Female		
	Under 14	Over 14	Under 14	Over 14	Under 14	Over 14	Under 14	Over 14	
528	5	43	7	23	10	265	6	159	10

GONORRHEA

Total Gonorrhea	Early Gonorrhea				Late Gonorrhea				Not Classified
	Male		Female		Male		Female		
	Under 14	Over 14	Under 14	Over 14	Under 14	Over 14	Under 14	Over 14	
254	3	114	2	32	2	67	3	20	11

A certain number of physicians noted that they did not treat venereal disease and, in addition, the list included technicians, internes and retired doctors, but of the total, 45 per cent. reported one or more cases. The largest number of cases reported by an individual was 46.

As compared with institutions, private physicians were treating fewer cases of syphilis but slightly more cases of gonorrhea, as shown in table II.

TABLE II

SYPHILIS AND GONORRHEA TREATED BY PHYSICIANS AND INSTITUTIONS

	SYPHILIS		GONORRHEA		
	Number treated	Per cent	Number treated	Per cent	Not Classified
Private physicians	528	34.08	254	52.48	
Clinics and institutions	1021	65.92	230	47.52	21

The majority of the cases classified under clinics and institutions were patients of the Vancouver Clinic of the Division of Venereal Disease Control. The returns from this treatment centre are shown in table III.

TABLE III

SYPHILIS AND GONORRHEA TREATED BY THE VANCOUVER CLINIC OF THE DIVISION OF VENEREAL DISEASE CONTROL

SYPHILIS

Male		Female		Total Syphilis
Under 16	Over 16	Under 16	Over 16	
25	692	22	219	958

GONORRHEA

Male		Female		Total Gonorrhea
Under 16	Over 16	Under 16	Over 16	
1	160	9	60	230

To what extent this statistical study represents a true picture of the situation must remain a matter of conjecture. The number of reported gonorrhea cases seems surprisingly low, as compared with generally accepted estimates elsewhere, even when the shorter treatment period and the excellent results obtained by the use of sulphanilamide are taken into account.

The proportion of venereal disease in Vancouver which is treated by private or public medical agencies can not be estimated. In other words, the committee had no way of determining whether the 2054 cases reported in the survey include the vast majority of venereal infections or merely a small fraction of them. Self-treatment and treatment by druggists and quacks undoubtedly are carried on, and certainly a considerable number of cases, particularly of latent syphilitics, are not diagnosed or treated by anyone. It may be possible at a later date to make a study of such extra-medical treatment, as was done in 1939 in the United States by the American Social Hygiene Association and the U.S. Public Health Service.

However, in so far as medical treatment is concerned, the findings of the Vancouver Laboratory of the Provincial Board of Health have provided an interesting comparison. Dr. C. E. Dolman, director of the Division of Laboratories, reviewed the results of the survey and made the following comment in a letter to one of the authors:

"Although the figures you have obtained in your survey are undoubtedly on the low side, since all the sources of error tend in that direction, your findings are not very discordant from those which we have been able to deduce to some extent from our laboratory work. Thus in 1939 the total number of positive Kahn blood specimens obtained from physicians and hospitals within the city of Vancouver, and from the Vancouver Clinic, was 3,881. The total number of positive smears for gonococcus obtained from the same sources during 1939 was 1,968. Of course our own figures under both headings are subject to correction in the opposite direction from your own, since these figures would include a goodly proportion of repeat

tests. However, if *all* positive specimens related to separate individuals, we should still have an incidence of the combined diseases slightly under 2 per cent., which is far different from the figure of 10 per cent. of the population suffering from syphilis which has been loosely bandied about in recent years.

"I might add, for your interest and that of members of the League, that the incidence of congenital syphilis in Vancouver, as shown by over 11,000 tests routinely done on infants born in the Vancouver hospitals over the past seven years, is at the maximum possible rate of 0.9 per cent."

It is the hope of the Greater Vancouver Health League to conduct similar surveys at future dates, possibly annually, in order to arrive at some conclusion as to the trend of syphilis and gonorrhea infections in Vancouver. Such conclusions would be an interesting corollary to the vigorous preventive and treatment program of the Provincial Board of Health.

SUMMARY

A survey by the Greater Vancouver Health League to determine the prevalence of syphilis and gonorrhea in Vancouver as at December 31, 1939, resulted in a tabulation of 2054 cases under medical treatment on that date, an incidence of 7.75 per thousand of the population. There were 1549 cases of syphilis (5.84 per thousand) and 483 cases of gonorrhea (1.83 per thousand) reported, plus 21 cases which were not classified. The medical profession cooperated generously and 96 per cent. of practising physicians responded, of which 45 per cent. reported one or more cases.

The incidence rate represents only known cases under medical treatment and it is incomplete to an unknown degree because the tabulation did not include those cases treated by quacks, druggists, or under self-treatment, or the cases which have not been diagnosed. However, in so far as medical treatment is concerned, the results obtained in the survey were confirmed in a general way by the findings of the Division of Laboratories, Provincial Board of Health.

Epidemiological Investigations in Quebec

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THE Province of Quebec, with an area of 594,534 square miles, is the largest province of our Dominion. The combined areas of France, Germany, and Spain are some 5000 square miles less than the area of Quebec. At home, Quebec could include within its boundaries the provinces of Ontario, New Brunswick, Nova Scotia, and Prince Edward Island and still have an excess of 130,715 square miles as room for sixty other Prince Edward Islands. Many of our counties are larger than some provinces and our province is larger than many countries.

Problem of Distribution of the Population

The estimated population of the province, for the year 1939, is divided as follows: cities of Montreal, Lachine, Outremont, Verdun, and Westmount, 1,069,500; counties organized in health units, 1,319,600; sanitary districts (remainder), 840,900; total population of the province, 3,230,000.

One-third of the population of the province is located on the Island of Montreal. We can rely on the active co-operation of the officials of the different bureaux of health of the insular cities, who have at their disposal well-trained personnel and efficient organizations. The other two-thirds of the population are quite evenly divided between the counties organized into health districts and those not so organized, which are known as sanitary districts. Then there are the far-away places, in unorganized territories, constituting a special problem which, however, on account of the dispersion of the population, distance, and great size of the areas, is seldom acute.

Island of Montreal

We have received from the different city health departments fine co-operation. The notification of cases of communicable diseases is made daily, so that our weekly report to the Department of Pensions and National Health, Ottawa, and our stencilled reports can be tabulated and issued on time.

As these cities maintain efficient departments for the control of communicable diseases, there has been no need for assistance to be given by the Province in investigations of communicable diseases. A uniform system of investigation has been adopted and copies of the standard epidemiological investigation forms are sent regularly to the Provincial Division of Epidemiology. As Montreal is the largest hospital centre of the province, the reports to the Division of Epidemiology not only assure us that control of infection is being

dealt with adequately within the city limits but often supply very important information that has a direct relation to cases occurring outside the Island of Montreal.

Again, the presence on the Island of Montreal of one-third of the population of the province results in conditions favourable to the occurrence and spread of communicable diseases. The incidence of communicable diseases in the population of Montreal and the adjacent municipalities is considered as our morbidity index and as the barometer of the incidence in the province.

Health Units

The administration of public health is the responsibility of the county health units. Each unit is under the direction of a full-time medical officer who has received the technical and practical training required for this position. As each medical officer has taken post-graduate training in public health and has received the Diploma in Public Health, he has had the opportunity of studying the fundamentals of epidemiology and is now applying these principles in the field. We consider each of these officers as a county epidemiologist, responsible for the detection of cases occurring in his own territory and the control of the dissemination of disease. The work of these officers has been of high order and they have been equal to every situation which they have had to cope with: this is only a just tribute to their skilfulness and to the quality of the teaching they received in their post-graduate work.

We receive daily the notification of the occurrence of cases of communicable diseases. The epidemiological cards and reports are also received when the investigation is completed. From these reports we obtain all the facts pertinent to other cases and bring this information to the attention of the interested officer. This exchange has many times proved to be very helpful and has resulted in permitting us to solve more quickly many epidemiological problems, thus preventing more cases and deaths.

Sanitary Districts

In the sanitary districts the burden of the control of communicable diseases lies with the municipal authorities. The head of the family and the physician, aware of a case of communicable disease, must report it to the secretary-treasurer of the municipality, who is, ex-officio only, the competent man to control infection. The municipal secretary has to notify the district health physician and the Division of Epidemiology, within twenty-four hours. He must also placard the house when necessary and institute quarantine. The district physician acts as public health adviser and controller. Of course only the district physician can make useful epidemiological investigations, but the municipality is held responsible for the enactment of the preventive measures indicated.

Unorganized Territories

A special health officer is sent to the community only when the reported conditions require his presence. The dissemination of the population is such that there are no serious epidemics in the unorganized territories.

COMMENTS

The organization of the other provinces of the Dominion is probably different from ours but the present system in Quebec is especially well suited to our needs. We have daily proof that every case of typhoid fever and diphtheria is investigated and controlled. We know too that the spread of other communicable diseases is held in check. The progress which is being made is well illustrated by reference to the incidence of typhoid fever in Quebec. The period from 1932-39 inclusive is reviewed in the following table:

Year	*Typhoid cases*	*Rate per 100,000 population*
1932	1,669	57.0
1933	1,421	47.7
1934	1,300	43.0
1935	1,125	36.6
1936	847	27.2
1937	1,554	49.5
1938	843	26.5
1939	712	22.0 (provisional)

In the course of eight years there has been a reduction of nearly 60 per cent. in the morbidity from typhoid fever. The incidence has been largely rural and the credit for this remarkable reduction is due to our county epidemiologists, who have conducted their work so efficiently.

Foster-Home Placement of Problem Children*

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IT is several years since the distinguished American authority on public health, Dr. Haven Emerson, stated that mental health is a definite part of a public health program, and one of the vital interests of mental hygiene is the problems of childhood. One of the earliest mental hygiene interests was in the mentally handicapped child, but attention was soon directed to juvenile delinquency, conduct disorders, habit training, and personality differences. And with the study of the individual child it soon became apparent that at least some of the difficulties arose in the home and in the family life.

The most necessary unit of social organization is the family, and the normal family group affords opportunity to develop fine qualities of character and to give expression to the various types of personality. But how far is wholesome living possible for children whose homes have been broken by death, disease, desertion or divorce, or made undesirable from a variety of other causes? "Society has been slow to reach the conclusion that those children who have been deprived of their own homes from any cause may be reasonably well served in the family life of people unrelated to them." Yet in Scotland, England, France, Germany, and many other European countries, foster-home care has been in use for a great many years, and for a number of years the use of foster-homes has become an established custom in the United States and, more recently, in Canada.

In their book, "Reconstructing Behaviour in Youth," published in 1929, Healy, Bronner, Baylor and Murphy give a wealth of accumulated experience of these scientific workers dealing with foster-home placement of some 500 problem children. Probably no persons in America have a greater fund of knowledge of problem children than these workers, whose combined opinions give real guidance in foster-home care of children. They emphasize the need of a careful study of the individual child and his problems before proceeding with any plan of treatment. The child's family must be tactfully dealt with. As far as possible existing social agencies should be used in carrying out any project and means should be used to correct undesirable attitudes and conditions in the child's own home so that if possible he may ultimately return to it, because in many cases the difficulties have arisen in the home rather than in the child. The foster-home should be carefully selected and the foster-

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parents prepared for their guidance. The child should be prepared for his new home and his role in it. He should have as many wholesome interests as possible. His church and Sunday-school activities are important, as are also his school interests. It is important to know the relations between child, parents, and foster-parents so as to determine whether to remove the child to another foster-home.

Some may raise the issue of foster-homes versus institutions for problem children. Certainly it is true that a small percentage of children who have unstable personalities and habits of deliquency such that they do not accept recognized authority in the home or in the community may be better dealt with in an institution. Even so, our experience has shown that after a period of time in a well-conducted training school most of these children later get along satisfactorily in good foster-homes. This principle has been used in Ontario in recent years with increasing success. On March 31, 1938, there were 92 wards of two boys' training schools and one girls' training school in boarding homes or foster-homes; on March 31, 1939, there were 127 so placed, while in June, 1939, this number had reached 190.

There has generally arisen considerable knowledge on which to predict the success or failure of such placement. For the most part, defective children, psychopathic children, those with unstable or peculiar personalities, those who have had encephalitis or epilepsy, are not suitable for placement, although we know of higher grade defectives who are quite stable who have been placed in suitable foster-homes and have become happy and useful citizens. In general, the more the child measures up to normal standards of physical and mental health, the greater the chance of success in placement.

STUDY OF ONE HUNDRED CHILDREN RECOMMENDED FOR FOSTER-HOME PLACEMENT

This study deals with one hundred children seen at the out-patient department of the Toronto Psychiatric Hospital during a period of about one year, and for whom foster-home placement or recommendations pertaining to placement were made. The material for the study was prepared by Miss I. M. MacKay, Reg.N., and Mrs. J. W. Wilshire, Reg.N., one year after our recommendations had been carried out.

Fifty-three of the cases were referred by the Children's Aid Societies, 15 from the Protestant Children's Home, 7 from the Industrial Schools, and the remainder from the Juvenile Court, the Division of Mental Hygiene of the Department of Public Health, public health nurses, and other social agencies in Toronto.

The ages ranged from 1 to 19 years, the largest number being in the age groups from 7 to 9 (28), and 12 to 15 (29). The smallest number was in the age groups under 5, 5 to 6, and over 15 (10 each). In the remaining age group, 10 to 11 years, there were 13.

Sex was fairly evenly distributed through all the age groups, except in the

group 7 to 9 years where there were 20 boys and 8 girls, and in the group 10 to 11 years, where there were 10 boys and 3 girls.

Sixty-six of the cases were born in Toronto and 24 elsewhere in Canada. The remaining 10 were from Great Britain, the U.S.A., and Europe. Forty-eight were of British nationality, including 5 French-Canadians, and of the 19 unspecified the majority were thought to be British. Fifteen were Hebrew and the remaining 18 included 4 Italians, 4 Poles, and 5 Ukrainians.

Forty-seven were Protestants, 39 Roman Catholics, and 14 Hebrews.

In the psychological classification, there were no mental defectives, 86 were of normal intelligence, and 14 in the borderline group of intelligence.

Forty-nine were said to be in good physical health. Defective tonsils were found in 22 and 16 had defective teeth. Other physical defects were present in 27, including cardiac conditions (7), defects of vision (7), underweight (5), speech impediment (2), etc.

Six were found to be showing symptoms of a psychotic tendency.

Fifty-six of the children came from foster-homes and 30 from their own homes. The latter number included some of the illegitimate children who were living with either of their parents. The remaining 14 were from Children's Aid shelters, industrial schools, etc. Twenty-one came from good neighbourhoods, 25 from only fair neighbourhoods, and 33 from congested neighbourhoods and poor homes. In ten cases the locality was not known. Eleven came from institutions. Fifty-two of the cases originally came from homes

TABLE I

BEHAVIOUR PROBLEMS

	0-4		5-6		7-9		10-11		12-15		16+		
	M	F	M	F	M	F	M	F	M	F	M	F	Total
Stealing	–	–	1	–	7	1	3	1	5	2	3	–	23
Lying	–	–	–	1	6	2	–	1	2	1	–	–	13
Truancy and running away	–	–	–	–	2	–	2	–	1	2	4	–	11
Temper tantrums	–	1	1	–	2	2	–	–	2	2	1	–	11
Fire setting	–	–	1	–	3	–	–	–	–	–	–	–	4
Out late at night	–	–	–	–	3	–	1	–	1	1	–	1	7
Masturbation	–	–	–	2	5	1	1	–	–	–	–	–	9
Sex and exhibitionism	–	–	–	–	–	–	1	–	1	–	–	–	2
Backward at school	–	–	–	–	2	1	3	–	–	1	–	1	8
Other school problems	–	–	–	–	6	2	–	–	1	1	–	1	11
Enuresis	–	–	1	–	4	1	–	1	1	1	–	–	9
Food fussiness	–	–	–	–	2	1	–	–	–	–	–	–	3
Destructive	–	–	–	–	5	–	–	–	–	–	–	–	5
Emotional instability	–	–	–	–	–	–	–	–	–	1	–	1	2
Seclusive, asocial	–	–	1	–	1	–	–	–	–	–	–	1	3
Stubbornness, sulkiness, resents authority	–	1	–	–	2	–	–	–	2	1	–	2	8
Disobedience, defiant	–	–	–	–	6	–	1	–	2	2	–	–	11
Fears, night terrors	–	1	–	–	1	–	–	–	–	1	–	–	3
Nail biting	–	–	1	–	1	–	–	–	–	1	–	–	3
Thumb sucking	1	–	–	–	1	–	–	–	–	–	–	–	2
Soiling	–	–	–	–	2	1	–	1	–	–	–	–	4
Stammering	1	–	–	–	–	–	–	1	–	–	–	–	2
Total	2	3	6	3	61	12	12	5	18	17	8	7	
	5		9		73		17		35		15		154
Per cent.	3		6		47		11		23		10		100
Standardization	3	4	3	2	6	4	3	2	8	5	–	–	40

from which either the father or the mother was permanently absent. There were in addition 26 illegitimate children.

In this study there were 9 cases of two siblings and 2 case of three siblings, there being 87 parents for the 100 children. Fifty-six of the fathers and 52 of the mothers showed social or mental abnormalities. Desertion ranked highest among these for both fathers and mothers, and immorality on the part of the mothers was the highest single factor; this does not include simple cases of illegitimacy. In addition, 7 fathers and 18 mothers were dead.

Sixty of the children presented conduct or behaviour problems, 108 problems being present by boys and 46 by girls. As will be seen in table I, stealing, lying, truancy, and temper tantrums occurred most frequently. School difficulties were a problem with 12 boys and 7 girls; of these, 8 were classified as backward. The problems were fairly evenly distributed among the intelligence groups, with 62 per cent. of the normal, 62 per cent. of the dull normal, and 65 per cent. of the borderline presenting problems. Twenty-one children presented one problem, 15 two, 10 three, 5 four, and 7 five and over. The two largest problem groups according to age were the groups 7 to 9 years and 12 to 15 years, accounting for 47 per cent. and 23 per cent. of the problems respectively. The 20 children coming from their own homes presented 36 per cent. of the problems, with 25 per cent. showing one problem and 75 per cent. more than one. The remaining 40 children presented 64 per cent. of the problems, with 40 per cent. showing one problem and 60 per cent. more than one. This indicates that the home environment exceeded other environments as a problem-producer by 8 per cent. and presented a greater number of problems per child.

Recommendations

Forty-two children were recommended for foster-home training because of the inadequacy or desertion of the parents. Twenty-five recommendations related to change of foster-home, mainly because of the inadequacy of the foster-parents. Twenty were recommended to remain in their present foster-homes, some being given medical advice. The other 13 were to remain in their present environment and were given advice regarding their problems.

SUMMARY OF RECOMMENDATIONS

Place in foster-home	42
Change foster-home	25
Remain in present foster-home (medical advice)	20
Remain in present foster-home with advice regarding problems	11
Remain in home with changed environment	1
Training in Industrial School, then foster-home	1

REASONS FOR CHANGING FOSTER-HOME

Undesirable attitude of mother	6
Lack of adequate supervision and control	9
Home attitude too rigid and critical	3
Death of foster-mother	1
Proximity to own mother	1
Difficult to discipline in city	1
Refused to keep child, did not understand	3
Too much work	1

Sixty-five of the recommendations were fully carried out, 79 per cent. with good success, 14 per cent. with fair or partial success (that is, making steady but slow progress, or making good progress in some problems but not

in others) and 6 per cent. were failures. In 14 cases recommendations were partially carried out; that is, carried out in some respects but not in all, or carried out for less than one year. Of these, 3 had good success, 9 fair or partial success, and 2 were failures. In 21 cases the recommendation was not carried out.

In the recommendations carried out, those of superior intelligence were completely successful; those of normal and dull normal intelligence, 81 per cent. and 78 per cent. successful, respectively; and those of borderline intelligence 50 per cent. successful. With regard to age, success was highest in the group 10 to 11 years, with 90 per cent. successful; in the group 12 to 15 years 79 per cent. were successful; in the group under 5 years, 80 per cent.; 5 to 6 years, 75 per cent.; 7 to 9 years, 44 per cent. (this group also presented 47 per cent. of the problems); and in the group over 15 years, only 20 per cent.

Twenty-one recommendations were not carried out. Of these, twenty were for foster-home placement. The greatest difficulty seems to have been the lack of co-operation of the parents, as will be seen from the following summary:

Parents did not co-operate	10 (9 mothers)
Agencies did not co-operate	6
Application withdrawn by relatives	2
Stayed on at domestic work	1
Absconded from school	1

In the remaining case, the recommendation was that a change of foster-home be made. Although a free home was provided, the parents would not co-operate.

In the recommendations fully carried out there were four failures. Two boys, both 9 years of age and with borderline intelligence, who presented many behaviour problems, have since been diagnosed as mental defectives and admitted to the Ontario Hospital, Orillia. One boy, 9 years of age with dull normal intelligence, has since developed the problems of lying and stealing and is to be re-examined. One boy, 9 years of age and with normal intelligence, who presented several problems, including disobedience and stealing which have persisted, has been placed in the Children's Aid Society Shelter in Walkerton, where he has been adjusting well for the past five months.

In the recommendations partially carried out there were two failures. One boy 9 years of age with normal intelligence, who presented many problems, was recommended for a home in the country, but he was, instead, placed in a good home in the city. His problems continued, although at times they seemed to improve. He has since been placed in the Training School for Boys at Bowmanville. The second case was that of a girl 13 years of age and with dull normal intelligence, whose problems were temper tantrums, sleep disturbances, and proximity to her own mother, who was an unwholesome influence. The recommendation was that she should be placed in a foster-home as far away as possible from her mother. This was carried out but as

the problems did not improve after a few months, she was placed in the Training School for Girls at Georgetown, where she is very much improved.

SUMMARY OF RECOMMENDATIONS PARTIALLY CARRIED OUT

Placed on farm for summer	2
Discharged to own home after few months	3
Transferred to Bowmanville and Georgetown	2
Mother did not co-operate after a few months	3
Placed in home in city instead of country	1
Placed with grandfather	1

In the recommendations fully carried out there were 10 cases with fair or partial success:

Boy, 8, normal intelligence, many problems; adjusting well socially but school progress poor.

Boy, 8, borderline intelligence, several problems; slow but gradual improvement, some of the problems still persisting.

Girl, 17, dull normal, poor school adjustment and only fair physical health; made fairly good adjustment but took French leave and was discharged to Over-Age Care; had several domestic positions thereafter in which she gave satisfaction; was burned to death in the summer of 1934.

Boy, 14, normal intelligence, truancy, running away, and stealing; very successful at first but later relapsed; possibly some conflict over early experience and parentage.

Girl, 8, normal intelligence, constantly lying and romancing; improved in health and general behaviour but emotionally disturbed over own family situation.

Girl, 9, normal intelligence, stealing and lying; has occasional relapses although altogether improvement is marked.

Girl, 7, dull normal, poor conduct at school, irritating, talked incessantly; slight improvement.

Girl, 8, normal intelligence, distractible, jealous, disobedient, temper tantrums, maladjustment at school; some of the problems have been overcome but still restless and hyperactive.

Boy, 11, borderline intelligence, poor progress at school and physical defects; progress only fair.

Girl, 14, truancy, running away, lying, and stealing; home situation unfavourable to systematic training; placed in foster-home and has shown general but slow improvement; lying and laziness still persisting.

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SOME RECENT DEVELOPMENTS IN POLIOMYELITIS RESEARCH

THE recent accumulation of reports on the presence of poliomyelitis virus in the stools of cases and contacts revives anew questions relating to the transmission of this virus. The possibility that the virus might make an exit from the body in the faeces was investigated in 1912 by Kling, Petterssen and Wernstedt. In fifty attempts to isolate the virus from the stools of active cases and convalescents, thirty-two infections were obtained which the authors regarded as evidence of recovery of the virus. Single successful isolations were reported by Kling and Levaditi (1913) and by Sawyer (1915). Thirteen years later, Kling reported five positive results in fifty-four attempts with stool specimens from acute and abortive cases and carriers. Sawyer successfully transmitted the infection to a second monkey, but Kling and his associates do not seem to have attempted to obtain this necessary confirmation. The incomplete nature of this experimental evidence and the general failure of careful epidemiological investigations to reveal indications of gastro-intestinal transmission account for attention being confined for so long to the nasopharynx as a reservoir of the virus.

In 1937, Harmon isolated the virus from the rectal washings of four cases. With improvements in the technique of isolation of the virus from stool specimens, successful isolations of the virus have since been made by a number of workers. Trask, Vignec, and Paul (1938) isolated the virus from three specimens obtained from an abortive case on the second, eleventh, and twenty-fifth days after onset. The virus was recovered from one of these specimens seventy-four days after collection. Kramer, Hoskwith, and Grossman (1939), out of twenty attempts, obtained one strain from faeces seven days after onset, and they also successfully isolated the virus both from the nasopharynx and faeces of another case nine days after onset. Kling, Ollin, Magnussen, and Gard (1939) isolated the virus by intraperitoneal and sciatic inoculations of monkeys from a non-paralytic case. Stool specimens of this case were found to be positive up to the thirty-first day after onset of illness. Lepine, Sedallian, and Sautter (1939) recovered the virus from the child of a man who contracted bulbar poliomyelitis. A specimen obtained four months later from this child produced transitory paralysis in a monkey which was presumably due to poliomyelitis

virus since the animal was subsequently found to be immune. Kling (1939) obtained the virus from one out of twenty-six samples of water collected from homesteads and districts invaded by poliomyelitis. The positive specimen was obtained from a homestead where poliomyelitis had been diagnosed the day before. Kramer, Gilliam, and Molner (1939) recently reported the occurrence of five cases of poliomyelitis in twenty pre-school children and infants in a children's home. The virus was recovered from stools of three out of twelve healthy children, intimate contacts of the cases, and from one out of eight adult contacts. In addition, the virus was recovered from two out of three children showing only fever of twenty-four to forty-eight hours' duration. Still more disturbing, however, is the demonstration by Paul, Trask, and Collotta (1939) of the presence of poliomyelitis virus in sewage samples obtained from two cities during epidemic prevalence of the disease.

It has generally been assumed that the virus of poliomyelitis is transmitted mainly by droplet infection. The demonstration of the virus in the nasopharynx of cases and contacts, the susceptibility of the monkey to infection via the olfactory tract, and epidemiological observations generally lend substantial support to this view. The seasonal distribution of cases, reaching a peak in months when bacterial diseases spread by droplet infection are at a minimum, does not necessarily argue against such a mode of spread. Obscure physiological variations or fluctuations in the poliocidal qualities of the nasopharyngeal secretions may be involved. Further, it is possible that in the absence of upper respiratory tract infections the virus can effect contact with nerve terminations more readily. Since there is no evidence of any animal reservoir of infection, it is necessary to postulate a widespread distribution of virus in healthy carriers in inter-epidemic as well as epidemic periods. The high frequency with which neutralizing antibody has been found in sera from individuals in areas where clinical infection is rare, points to a world-wide distribution of the virus, and the problem of why poliomyelitis favours certain areas of the globe as far as endemic frequency and epidemic tendencies are concerned remains unsolved.

Recent observations on the occurrence of poliomyelitis virus in the stools of cases and contacts and its isolation from sewage do not mean abandonment of the view that the virus is generally dispersed from the mouth and nasopharynx nor do they indicate that poliomyelitis should be regarded as a gastro-intestinal infection. The virus survives passage through the gastro-intestinal tract in monkeys and it is reasonable to assume that the virus can similarly traverse the entire gastro-intestinal tract of man. Thus the presence of virus in the stools of cases and contacts may be attributed merely to swallowing of nasopharyngeal secretions in which the virus is present. Technical limitations may explain failure to recover virus from the nasopharynx when it is present in the stool or from the stool when it is present in the nasopharynx. The variable success which has attended attempts to isolate the virus from stools of cases may indicate that this mode of exit is only an occasional one or, on the other hand, may result from unknown and variable factors in stool extracts preventing recovery of the virus in a specimen in which it is present. The successful recovery of virus

from sewage specimens, however, emphasizes the potential dangers which arise from the elimination of the virus in the stools. Nevertheless, it is doubtful how far proper treatment and disposal of dejecta from paralytic and abortive cases alone will reduce the hazard, since the virus has also been isolated from the stools of healthy contacts. While there has been little epidemiological investigation which might be interpreted as evidence that poliomyelitis virus may be occasionally water-borne, several milk outbreaks have been reported, the most notable being the Broadstairs epidemic. Some of the epidemiological vagaries of poliomyelitis suggest that the disease may be spread in more than one way. It may well be that less frequent, but nevertheless important modes of spread of the disease are obscured by the effects of general dissemination by droplet transmission. Transmission of the virus by sewage-contaminated water, or by milk or food contaminated by flies or as a result of unhygienic habits, now seem to be more than theoretical possibilities, and obviously appropriate preventive measures should be taken. However, we can only speculate at present on the general significance of such possible modes of spread. This is a matter for combined epidemiological and laboratory investigation when favourable opportunities arise.

Much work has been done in the hope of discovering a more suitable animal than the monkey for experimental work with poliomyelitis virus. Armstrong (1939) has recently reported the successful transmission of the virus to the Eastern cotton rat, and serial transfer for twenty-six generations in this animal. The histological lesions produced in the cotton rats were typical of poliomyelitis and monkeys inoculated with the third, fifth, and sixteenth cotton-rat transfers developed severe poliomyelitis. The identity of the virus has been further confirmed by neutralization tests. Following adaptation to the Eastern cotton rat, the virus has been successfully transmitted and adapted to mice. Although only one strain of virus has, as yet, proved infective for the Eastern cotton rat and the mouse, and evidence of immunological differences between strains of poliomyelitis virus has been accumulating, this work would seem to hold promise of a further advance in the knowledge of poliomyelitis. In particular, if other strains of poliomyelitis can be mouse-adapted, this should make possible extensive serum surveys to determine the distribution of poliomyelitis neutralizing antibody in different populations and in different age-groups. Assuming that poliomyelitis neutralizing antibody represents a specific immunological response to infection with the virus, such surveys should throw light on two important questions. One of these concerns the relationship between circulating neutralizing antibody and resistance to infection of the central nervous system; the other relates to the distribution of the virus and spread of subclinical infection in different populations.

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THE LABORATORY SUPPLEMENT

WITH the continued expansion of the field of public health laboratory work in Canada, the Laboratory Section of the Association has rendered an important service in making possible the annual presentation of important new work through the holding of the Christmas meeting and the publication of abstracts of the papers presented at the meeting. Particularly during the past five years, the Association has assumed additional responsibilities and has expanded the studies conducted through various national committees. As a result, the Editorial Board has found difficulty in accommodating the papers presented for publication from these various sources. At the same time, the Board has realized that the JOURNAL, to be of the greatest service, must endeavour to serve the health officers and other public health personnel by publishing a journal which relates to the whole field without undue emphasis on the laboratory or other fields. To meet the need, it is planned to publish from time to time, as an addition to the present JOURNAL, a section which will be known as the Laboratory Supplement, for the purpose of publishing technical papers of interest to those engaged in laboratory work. The publication of these papers, representing the results of studies conducted in universities and in various public health laboratories, is a responsibility of the Association because the advances in laboratory work are fundamental to the progress of public health. It is realized that often these papers are appreciated only by those familiar with such work, and that their publication should not exclude the publication of papers of more general interest. The extent to which the Laboratory Supplement may be issued is dependent on the financial support which may be obtained through the Laboratory Section. It is the desire of the Editorial Board to assist the Laboratory Section in meeting this need and in furthering the interests of all who are concerned in public health laboratory work, particularly when the facilities for the publication of laboratory papers are so limited in Canada.

PUBLIC HEALTH ADMINISTRATION

Treatment of Dartmouth Municipal Water for Taste and Odour

FOR some years there had been numerous and persistent complaints during the summer months in regard to the objectionable taste and odour of the town water. Repeated laboratory examinations showed the water to be free from harmful pollution and pathogenic micro-organisms. It was thought that very likely the characteristic odour and taste were caused by the growth of algae. The odour was described as "fishy" and the taste was equally offensive, suggesting decay or putrefaction.

The reservoir is a natural reservoir, advantage having been taken of two lakes situated two and a half miles from the town. The upper lake is known as Topsail Lake and the lower lake as Lamont Lake. A canal uniting the two lakes was constructed and the water flows by gravity to the town through pipes placed at the lower end of Lamont Lake. Suitable control valves are provided. The reservoir provides for the storage of 475 million gallons.

Copper sulphate was added to provide a concentration of 2 pounds per million. The quantity of copper sulphate required, namely 900 pounds, was divided into 25-pound lots and placed in bags consisting of double layers of cheese-cloth. Using a boat, these bags were drawn through the water of both lakes.

It was found, however, before this procedure was completed that certain fish, namely suckers, perch and minnows, were being killed. The dead fish were first noticed in and about the canal connecting the two lakes. Further treatment of the water was stopped and each day the lakes were inspected for dead fish. These observations were made for a week. Among the dead fish no trout were found. The total casualties consisted of 434 suckers and 187 perch and minnows. A total of 775 pounds of copper sulphate had been used. No evidence of the presence of copper sulphate could be detected on drinking the water. The objectionable taste and odour were eliminated soon after the treatment had been commenced.

In the following year (1936) the amount of copper sulphate used was reduced to 370 pounds. No fish were killed and the disagreeable taste and odour were satisfactorily eliminated. In 1937 we further reduced the amount of copper sulphate to 350 pounds and satisfactory results were obtained. The cost of the procedure is comparatively small, the copper sulphate costing seven cents a pound. The cost, in 1937, exclusive of the labour, was about thirty dollars—a very insignificant amount for the results obtained.—*E. I. Glenister, Medical Officer of Health, Dartmouth, N.S.*

From the Annual Report of the Medical Health Officer of Brantford, Ontario

Dr. W. L. Hutton, Medical Officer of Health of Brantford, in his annual report for 1939, issued recently, records that Brantford has been kept free from diphtheria for nine years. This has been accomplished by a continuous program of immunization. In the field of tuberculosis control, 2825 school children were given a tuberculin test during the year. Of this number, 201 reacted positively and were examined by X-ray. As a result, four children were admitted to the preventorium at

Brantford Sanatorium. In addition, 282 employees at two factories were similarly tested. Of this number, 134 reacted positively and, following X-ray examination, one open case was discovered and admitted to the sanatorium.

Brantford, with an assessed population of 31,497, established a record in 1939 of no maternal deaths among residents. The infant mortality rate increased, however, from 55.6 in 1938 to 62.6 in 1939. Seven babies died of a gastro-intestinal infection and many others suffered from the same infection but recovered. In commenting on the increased infant mortality rate, Dr. Hutton states:

"This increase is disturbing and every endeavour should be made to reverse this undesirable trend. It therefore becomes necessary to study the causes of our high infant mortality. In last year's report I gave some facts which showed a definite connection between the large number of births to citizens on relief and our excessive infant mortality. The following table shows that these same factors continued to operate during 1939:

	1938 Brantford	1939 Brantford	1939 Hamilton
Average number of citizens on relief	3974	3791	13,500
Percentage of population on relief	12.6	12.3	8.6
Number of babies born to parents on relief	141	132	255
Number of babies born to each 1000 persons on relief	35.4	34.8	18.8
Number of babies born to each 1000 persons not on relief	11.2	11.2	16.2

"The implications of these figures should be frankly faced by the citizens of Brantford. I have corresponded with health officers in other cities and have been surprised to find that this wide difference between the birth rate of citizens not on relief and the birth rate of citizens on relief does not apply to the same extent in other cities. As an example, I have included in the above table certain figures from the City of Hamilton, and as will be seen, in that city there is little difference between these two birth rates. Obviously babies born into families where the heads of households are employed full time at fair wages have a far better chance of survival than babies born into families where security of employment is lacking. What then can be said in favour of a situation where three times as many babies are born into families where security of employment is lacking as compared with the first group? I question whether this situation is in the public interest, and I believe that if fewer children were born to families who are undergoing financial hardships, our baby death rate would be lower. On the other hand, Brantford as a whole has a very low birth rate and it would be most desirable if more children were born to families where there is security of employment. The tendency towards smaller families so evident among the majority of citizens is intimately related to the economic trend of the times, and improvement of economic conditions would doubtless be reflected in a higher birth rate among the majority."

PROGRESS IN FORT WILLIAM

IN his annual report for 1939 Dr. John H. White, Medical Officer of Health of Fort William, reviews the progress made in the control of diphtheria, smallpox, and scarlet fever. The infant mortality rate reached a low point of 43.8, being a reduction from 51.9 in 1938. During the year 564 persons were examined for tuberculosis in the 52 chest clinics which were held. One hundred and twenty-five persons were under observation and 29 cases of tuberculosis were re-

ported as compared with 21 cases in 1938. A total of 250 children were immunized for diphtheria and 355 were vaccinated against smallpox. Preventive treatment for goitre was provided for 493 children.

CARRIERS AND DIPHTHERIA

EDMONTON, Alberta, is known for the efficiency of its health program. A high percentage of school children have been immunzed against diphtheria and also against scarlet fever. Efforts have been made to reach the preschool groups in connection with diphtheria immunization program. Recently an outbreak of diphtheria occurred in a class of forty in one of the primary grades of a city school. Five cases occurred, one of which was fatal. Prompt control measures prevented further cases. Swabbing revealed the presence of three carriers of virulent organisms. The outbreak serves to emphasize the constant danger of the occurrence of diphtheria when unprotected children are brought together. Dr. G. M. Little, Medical Officer of Health, has stressed in the press the necessity of the immunization of preschool children. The occurrence of this outbreak confirms his message to the community.

FELLOWSHIPS IN VENEREAL-DISEASE CONTROL

As part of the comprehensive program of the Division of Venereal-Disease Control of the Provincial Board of Health of British Columbia, a series of post-graduate fellowships in venereal-disease control has been established. The fellowships are for the purpose of providing training in diagnosis and treatment of venereal disease and in public health and welfare aspects of this problem. Instruction will be provided by qualified consultants at the Vancouver Clinic. The fellowships extend over a period of three months. The first six weeks are devoted to general diagnosis and treatment of syphilis and male gonorrhoea, the second six weeks to the diagnosis and treatment of female gonorrhoea, prenatal syphilis, neurosyphilis, etc. The fellows are required to attend five mornings a week and two evenings a month. Provision has been made for eight fellowships. An honorarium of fifty dollars a month is provided and the fellowships are open to qualified physicians licensed and resident in British Columbia. Applications should be addressed to Dr. D. H. Williams, Director, Division of Venereal-Disease Control, 2700 Laurel Street, Vancouver.

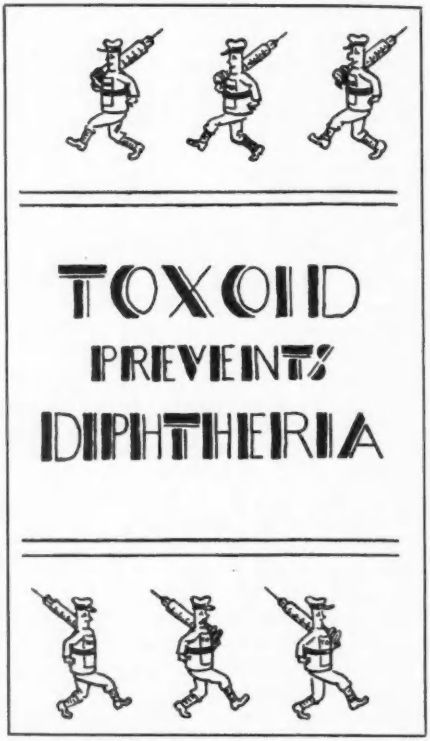
THE PUBLIC HEALTH NURSES ASSOCIATION OF THE DEPARTMENT OF PUBLIC HEALTH, TORONTO

THE public health nurses of the Division of Public Health Nursing of the Department of Public Health, Toronto, have formed an association of their members to be known as the Public Health Nurses Association of the Department of Public Health, Toronto. The objects of the association are: to promote the standards and objectives of public health nursing, especially as they relate to the members' work; to promote understanding, good-will, and esprit de corps among the members, to assist with and promote staff education, to assume responsibility for social activities, and to deal with matters relating to the welfare of the staff members. A representative from each of the ten units of the Division constitutes the executive officers and committee convenors of the Association. The executive members: Honorary President, Miss Elsie Hickey; President, Miss Elvira Manning; First Vice-President, Miss Isabel MacLeod; Secretary, Miss Margaret Winfield; Treasurer, Miss Evelyne Van-Lane; Corresponding Secretary, Miss Mary Gridley; Convenor of Education Committee, Miss Pearl McGinnis; Convenor of Social

and Courtesy Committee, Miss Viola Copp; Convenor of Ways and Means Committee, Miss Florence Conlin; Convenor of Publicity, Miss Marjorie Larkin; Archivists, Miss Frances Brown and Miss Janet Neilson.

AN ATTRACTIVE DIPHTHERIA-TOXOID FOLDER

THE Department of Health and Public Welfare of Manitoba recently issued a folder for increasing the interest in diphtheria-toxoid immunzation. The folder is printed in two colours, blue and black, on white stock. On a pale blue background the words "Toxoid Prevents Diphtheria" are outlined in hand-drawn letters. The toxoid soldiers, such as might be drawn by any of the children reading the pamphlet, attract attention. On the inside of the folder the word "Diphtheria" is displayed and, carrying forward the idea of the cover: "Let us all get together and defeat it. It can and must be done." There is a commendable absence of scientific terms. The message is encouraging and ends with: "Are we interested



DIPHTHERIA

LET US ALL GET TOGETHER AND DEFEAT IT! . . . It *CAN* and *MUST* be done

WE ALL KNOW pretty well what Diphtheria is. It is a "germ" disease which spreads very rapidly from one person to another, either by direct contact or by means of "carriers" and infected clothing, dishes, common drinking cups, etc.

It is a KILLING disease, and is deceitful by its seeming mildness at times.

In the old days before the discovery of antitoxin and toxoid, it wiped out whole families and even communities because of its severity. It was dreaded as much as Smallpox.

It attacks all ages, but is much more apt to attack young children, especially those from six months old up. It is also more severe in these younger children and causes more deaths. Even when apparently mild it may leave serious heart and nerve complications.

Antitoxin has been a wonderful help in its treatment, and if given early enough and in large quantities, will save life and probably prevent complications.

BUT! How do we know that we are going to catch the disease early and get the antitoxin in time? We don't want our children even to be sick with Diphtheria, let alone die of it, do we?

And that is where TOXOID comes in!

IT WILL PROTECT OUR CHILDREN AGAINST TAKING THE DISEASE

It is usually given in three small doses under the skin. These doses are spaced about three weeks apart. Each dose hurts only about the same as a mosquito bite, so there is no need to fear it. There is no "sick" reaction to it, if given before the age of ten years;—Even after ten years there is either very little or no reaction.

It is best given as soon after the age of six months as possible, and then a fourth dose just before the child enters school.

We even have a test,—known as the Schick Test,—which tells us if the child has been protected.

Toxoid is not a treatment for the sick, but is a preventive against the disease and is almost perfect. It acts by building up a person's resistance against the Diphtheria germs and the poisons or toxins formed by them.

Are we interested enough in our children to use this wonderful protector? I AM SURE WE ARE!

SEE YOUR DOCTOR OR HEALTH OFFICER TODAY AND MAKE ARRANGEMENTS TO HAVE YOUR CHILDREN PROTECTED AGAINST THIS DREAD DISEASE—*DIPHTHERIA*

enough in our children to use this wonderful protector?" The printing is well done and the blue border adds to the attractiveness of the page. This is one of the pamphlets prepared by the Division of Health Education under the direction of Dr. A. Marguerite Swan, D.P.H.

DIPHTHERIA IN QUEBEC CITY

DURING January, 1940, 60 cases of diphtheria, with 3 deaths, were reported, as compared with 94 cases and 4 deaths in January, 1939. Of the cases in January of this year, 22 were residents of the city, as compared with 67 of the cases in January, 1939. Two of the deaths were in residents. An active program is being carried forward by the Department of Health of Quebec under the direction of Dr. Berchmans Paquette.

SCARLET FEVER IMMUNIZATION IN REGINA

A CITY-wide campaign against scarlet fever has been undertaken by the Department of Health of Regina under the direction of Dr. George R. Walton, Medical Officer of Health. This is a continuation of the program which has been successfully conducted. A total of 3492 persons were inoculated in Regina against this disease from October 1, 1938, to December 31, 1939. Of the 55 cases of scarlet fever reported in 1939, 31 were children of school age. Of this number only 3 had received the preventive treatment. The incidence of scarlet fever has shown a marked decline. During the years 1936, 1937 and 1938 a total of 1323 cases of scarlet fever were reported, while in 1939 only 55 cases were reported. Estimating the financial saving, Dr. Walton estimated that during the previous three years the city had paid over $11,000 for hospitalization of indigent cases of scarlet fever, while in 1939 the cost was only $265. Estimating a minimum cost of $100 for the treatment of one scarlet fever patient, the cost to citizens of Regina from 1936 to 1938 inclusive would be $130,000 for treatment. Further, Regina had only 2 cases of diphtheria when the expected number from previous experience would have been 152. The saving to the municipality, in the instance of diphtheria, smallpox, and typhoid fever, represented $32,600, based upon minimum figures of the cost of treatment of each of these diseases. This estimated saving was an amount which exceeds the cost of operating the city health department. During the year 782 children received the complete diphtheria toxoid treatment and 2725 children the complete course of scarlet fever inoculations. In addition 1032 children were vaccinated against smallpox and 162 against whooping cough.

FORMATION OF THE UNITED COUNTIES HEALTH UNIT IN ONTARIO

ANNOUNCEMENT has been made of the establishment, following a five-year demonstration period, of a health unit for the united counties of Stormont, Dundas, and Glengarry, in Ontario. The demonstration unit was known as the Eastern Ontario Health Unit and served the counties of Stormont, Glengarry, Prescott, and Russell. Dundas county and the city of Cornwall, which were not included in the Eastern Ontario Health Unit, will be served by the new unit. The estimated cost of the services is $30,000, of which the Provincial Government is to provide one-half. Dr. G. Murray Thomson will continue as Medical Director, assisted by three part-time medical officers, and the requisite public health nursing and sanitary staff. The headquarters of the unit will be in Cornwall.

JOHN ANDREW AMYOT, M.B., C.M.G.

ON February 16, at his home in Ottawa, Dr. John Andrew Amyot passed away following an illness which occasioned his retirement from the Department of Pensions and National Health in 1933.

Dr. Amyot was born in Toronto on July 25, 1867, and received his early education at Assumption College in Sandwich, Ontario. He early developed a philosophy of life which was based on a love of humanity and a zeal for justice. Throughout his life these principles were ever in evidence, and his strong religious faith made him untiring in his efforts for what he believed to be right and in the best interests of those whom he served.

Completing his medical course in the University of Toronto in 1891, he served as house surgeon in the Toronto General Hospital, becoming a demonstrator in pathology in 1892, a field in which he maintained his interest throughout his life. In 1894 he was appointed assistant surgeon to St. Michael's Hospital, Toronto, and later became surgeon. His interest in pathology and bacteriology, however, caused him to relinquish a career in surgery and to assume, in 1900, the direction of the Provincial Board of Health Laboratory. Under Dr. Amyot's direction the service rendered to the physicians of Ontario increased to such an extent that enlarged laboratories had to be provided in 1911. His interests, however, were not confined to the laboratory. He became a leading exponent of sanitation and of the pasteurization of mlik in Ontario; in 1912 he was appointed co-director of the International Waterways Commission for the investigation of the Great Lakes and boundary waters; and he established the Ontario Experimental Station for the study of the problems of sanitation. His ability as a teacher was early recognized by his appointment as Lecturer in Comparative Physiology in the Ontario Veterinary College in 1898 and as Professor of Preventive Medicine and Hygiene in the University of Toronto in 1910.

Although well past the years for active army service, Dr. Amyot was among the first to volunteer in the last Great War. He proceeded overseas with the Second Canadian Division in 1915 and was appointed as Adviser in Sanitation to the Canadian Corps in France in 1916. He served as D.A.D.M.S. to the Second British Army in France in 1916 and as Consultant to the Canadian Overseas Forces in England from 1916 to 1919. The valuable services which he rendered were recognized by the honour of C.M.G., conferred on him in 1918.

At the close of the war, he was the first choice of all concerned in public health administration for the appointment of Deputy Minister in the newly created Department of Pensions and National Health. In the formative years of this department he safeguarded its interests and struggled to achieve the ideal which he held for it. He possessed in a unique way a sense of what was practical and had an inherent hatred of everything that he believed to be false. He stood for his convictions and all who knew him realized the honesty of his character and his faithfulness to duty. To the American Public Health Association and to the Canadian Public Health Association, which he served as President in 1920, he gave generously of his time, as he did to other voluntary agencies. When forced by illness to retire as Deputy Minister of Pensions and National Health, he continued to

follow with keen interest the development of the Department and the progress of social legislation. Dr. Amyot was privileged to enjoy a rich family life. No honour which he himself received gave him greater pleasure than that which his son Gregoire received in being appointed, just a month before his father's death, as Provincial Health Officer of British Columbia.

Dr. Amyot's life will long continue to influence the many who knew him, and, through them, the whole field of public health.

BOOKS AND REPORTS

Classic Descriptions of Disease. *By Ralph H. Major. Charles C. Thomas, 220 East Monroe Street, Springfield, Ill., 1939. 716 pages. $5.50.*

IN CLINICAL TEACHING and in the practice of medicine, knowledge of the original accounts of disease and medical discoveries is of great value. Access to an authoritative reference on such classics for student and physician was provided by the first edition of Dr. Major's book, CLASSIC DESCRIPTIONS OF DISEASE, which appeared in 1932.

The second edition of this volume, enlarged and revised, is now available. New material included comprises sections on malaria and yellow fever, as well as additional readings and illustrations on other topics. The index has been extended and much of the biographical material re-written. The book now contains 403 selections from original accounts of 190 medical authorities, men whose work and writings have constituted epoch-making events in clinical medicine.

The text is divided into ten sections: Infectious Diseases, Diseases of Metabolism, Lead Poisoning, Diseases of the Circulatory System, Diseases of the Blood, Kidney Diseases, Respiratory Diseases, Deficiency Diseases, Allergic Diseases and Diseases of the Digestive Tract. The author's short biographical sketches and his summaries preceding the various sections are most valuable.

The descriptions and accounts which form the principal part of the book are "either the first known, one of the earliest, or one of the most interesting accounts of the diseases in question." Descriptions of disease, methods of treatment and diagnosis presented extend over the whole field of clinical medicine from the earliest to modern times. The translations into English of original writings in Latin, Spanish, French, and German were made in most instances by the author, and this in itself is a noteworthy achievement.

There are 137 selected illustrations including portraits and drawings of apparatus, etc., which add substantially to the interest of the reader. The book is beautifully printed and bound, a credit indeed to the publishing house.

A. Hardisty Sellers

Food Control — Its Public Health Aspects. *By James Houston Shrader. John Wiley & Sons Inc., New York, 1939. 513 pages. $4.00.*

DR. SHRADER has in the past made distinct contributions to our knowledge of food control, and this book answers a long-felt need on the part of students and officials for a concise treatment of this important branch of public health work. It should be enthusiastically received.

The book covers all the significant points and brings together the various aspects of food control, which, though already presented in text-books and other writings, are rather extensive and voluminous for the busy official or student.

The author's objective in writing this book "has been to meet the needs of students of public health and food control, food chemistry and nutrition, home economics, nursing, and preventive medicine." Perusal of this work indicates that this objective has been fully achieved. "Some important foods have not been included because they have not been associated with any significant amount of illness. Their relation to regulatory control has been chiefly their possible adulteration and misbranding." The author agrees that "some inconsistencies are entailed by such an arbitrary selection" and cites as an example, "the inclusion of jellies, to which no illness has been traced, and the omission of bottled beverages, which have been the subject of regulation. But preserved foods, as a class, present an important problem both in food control and in the public health, whereas the omitted foods do not possess this latter significance."

From the first chapter which deals with the problem of food control, through those on the relation of food to the public health; the production, certification and pasteurization of milk, and milk and dairy products; meat and meat products; cereals and bakery products; fresh fruits and vegetables; to the last, dealing with preserved foods, there is a fund of information presented in an attractive way, which will be invaluable as a source of reference for the student, the teacher, and the public health officer.

Not the least estimable feature of the work is the list of references following each chapter. The book terminates with appendices on "Equivalence of Vitamin Units," "Digest of the New Federal (U.S.A.) Drug and Cosmetic Act," and with an excellent index.

As a most valuable contribution to the general subject of food control, we have no hesitation in commending the volume to all interested in public health.

A. R. B. Richmond

The Patient as a Person. *By G. Canby Robinson. The Commonwealth Fund, New York, 1939. 440 pages. $3.00.*

DR. ROBINSON'S association with medical social service extends back almost to its beginnings and he therefore brings to his subject a wealth of experience, observation, and philosophy. This volume is an attempt to illustrate concretely the importance and necessity of a correlated study of the actual conditions of a patient's life and his illness in order that a fuller measure of comprehensive therapy may be successfully applied. One might say that it is a plea that the "art" of medicine be not lost in the avalanche of scientific advance and organization.

The author focuses his attention on the large clinic and hospital services where the greatest danger lies of submerging the patient's individuality and problems. Case histories of patients suffering from circulatory, respiratory, digestive and various other conditions are presented and analysed to show the important bearing of the social and emotional background as contributing factors in the illness and its outcome.

There is much food for thought in these pages and this re-emphasis of an apparently obvious but too often neglected feature of medical care is both highly commendable and timely. Not the least important question raised for consideration is the training of the doctors of the future in this regard. It is to be hoped that this stimulating and convincing work will receive the attention it so well deserves.

F. O. Wishart

CURRENT HEALTH LITERATURE

These abstracts are intended to direct attention to articles that have appeared in other journals during the past month. Any of the journals referred to may be borrowed for three days or longer if desired. Address requests to the secretary of the Editorial Board.

Tuberculosis in Medical Students and Young Physicians

THIS study deals with the development of tuberculosis in 400 medical students observed for from 6 to 8 years after graduation from the School of Medicine of the University of Pennsylvania. Examination with tuberculin test and X-ray of students was begun at the Henry Phipps Institute in 1930 and the follow-up was conducted through this Institute. Information was sought concerning the incidence and course of tuberculosis in these 400 physicians who had been examined as members of the classes graduating from the medical school in 1930, 1931 and 1932. By questionnaire accurate information was obtained concerning the health of more than 98 per cent. and in addition recent X-ray films were taken of a considerable number for comparison with films taken during the medical course.

Clinical tuberculosis requiring sanatorium care or collapse therapy developed within 6 to 8 years after graduation in fifteen physicians, ten of whom had positive sputum. Two of these had clinical tuberculosis in medical school before routine examination of students was instituted. Three had been negative on X-ray examination on graduation while asymptomatic tuberculous lesions of various types described in a previous report were discovered during the medical course in the remaining ten. In eight of the fifteen, symptoms developed in the first two years after graduation. In three cases clinical illness requiring sanatorium care had interfered with their medical course but there was no recurrence of symptoms following graduation during this observed period. Thus the total of eighteen or 4.5 per cent. represents the number of physicians whose studies or practice had suffered serious interference because of tuberculosis. This incidence is somewhat higher than in similar studies conducted in other medical schools but the case mortality among these physicians was low, only one death occurring from tuberculosis.

With regard to the medical students a high incidence of asymptomatic infiltrations had been found. Of these, the flocculent type of infiltration, particularly when appearing below the clavicle, frequently resulted in clinical illness after graduation. Students with lesions similar in character and extent who were diagnosed as having manifest tuberculosis less often developed serious disease after graduation, probably because of more radical restriction of activities and of increased rest as advised. Generally speaking it was found that definite ill health was rarely caused by tuberculous infiltrations until lesions became moderately advanced. This applied even to physicians whose impairment of health, sufficient to arouse a suspicion of tuberculosis, was apparently not noticed while lesions were minimal.

It was concluded that asymptomatic tuberculous infiltrations progressed to clinical and fatal disease to a much less extent in medical students than in other groups of the general population taken in large. This may be attributed principally to the willingness with which medical students and physicians undergo treatment when symptoms are either slight or absent.

H. W. Hetherington and Harold L. Israel, Am. J. Hyg., 1940, *31*: 45.

Dermatitis among Plate Printers

THE frequency of recurrent cutaneous lesions of the hands and arms among plate printers in a large printing establishment resulted in a great loss of time and money, as well as inconvenience and suffering among the workers. A thorough investigation was therefore made regarding the daily routine of the individuals, their occupational history, past and present medical histories, evidence of family allergy and the possible role of fungi. Physical examinations were made and the types of cutaneous lesions studied.

The findings pointed definitely to a dermatitis of occupational origin due to the inks and cleaning materials used for the plates and skin and exacerbated by the mechanical trauma of the occupational process. Hypersensitivity after exposure to the causative agents for a year or more was evident in about 25 per cent. Fungi were of minor importance.

Recommendations for control of the condition included general hygienic measures, among others medical examination before and during employment, the use of rubber gloves and protective clothing, the prohibition of abrasive cleaning agents and strong alkalis, and in so far as possible individual equipment.

P. A. Neal, J.A.M.A., 1940, *114*: 558.

On the Presence in Syphilitic Serum of Antibodies to Spirochetes, Their Relation to So-called Wassermann Reagin, and their Significance for the Serodiagnosis of Syphilis

THE experiments described in this paper show that syphilitic sera absorbed with spirochaetal suspensions no longer react with Wassermann or flocculation test antigens or with spirochaetes. Syphilitic sera absorbed with tissue lipoids become Wassermann and flocculation negative but reactions (agglutination and complement-fixation) with the spirochaetes are little changed. Rabbits immunized with tissue lipoids develop antibodies for spirochaetes to high titre.

The tissue extracts and Treponema pallidum therefore appear to contain "antigen" which if not identical is closely related serologically. Further, the culture strain of spirochaete used in these experiments is sufficiently closely related to those obtained from human cases to react with the antibodies in syphilitic serum.

The data here presented lend strong support to the view that the "reagin" present in syphilitic serum is an antibody since it reacts with spirochaetes. These findings do much to settle the mystery of the non-specific nature of the Wassermann and flocculation reactions in the diagnosis of syphilis. It is further suggested that suspensions of cultured spirochaetes may replace the present tissue extracts as antigens for these tests.

Harry Eagle and Ralph B. Hogan, J. Exper. Med., 1940, *71*: 215.

Students' Health Service of Dalhousie University

SINCE 1931 all students attending Dalhousie University have received an annual physical examination carried out at the Dalhousie Public Health Clinic by the members of the staff. The study records the physical defects and disease present in a group of 2187 students. According to the personal histories, 18.4 per cent. had suffered from scarlet fever, 5.5 per cent. from diphtheria, 12.8 per cent. from tonsilitis, and 11.5 per cent. from pneumonia. Of the group 55.5 per cent. had had a tonsillectomy and 12 per cent. an appendectomy. Eighty-six per cent. had been vaccinated before entering the university. Eleven per cent. of the group showed diseased tonsils, and 3.2 per cent. enlarged tonsils. Data are submitted concerning the physical findings and it is noted that the group should be considered a select one. The value of the examination from the educational standpoint is emphasized.

Nova Scotia Med. Bull., 1939, *18*: 658.

LABORATORY SUPPLEMENT

FOR THE PRESENTATION OF TECHNICAL PAPERS IN BACTERIOLOGY, PATHOLOGY, IMMUNOLOGY, CHEMISTRY, PARASITOLOGY, AND ALLIED FIELDS IN RELATION TO PUBLIC HEALTH

The Application of the Photelometer to Kay and Graham's Phosphatase Test

J. WYLLIE, M.A., M.D., B.Sc., D.P.H.
Professor of Preventive Medicine, Queen's University, Kingston, Ontario

THE phosphatase test is a useful means of assessing the degree of efficiency of pasteurisation. The test, devised by Kay and Graham(1) in 1933, was considerably modified in 1935(2) and minor alterations were suggested in January(3) and February(4), 1937. Phosphatase is an enzyme present in raw milk and is almost completely destroyed by efficient pasteurisation, i.e. by heating milk to a temperature of 145°F., maintaining it at that temperature for 30 minutes, followed by rapid cooling to 50°F. or lower. The important feature of the test, from the public health viewpoint, is that *B. tuberculosis* is destroyed rather more quickly than the enzyme phosphatase, so that milk which has been properly pasteurised may confidently be regarded as free from all the common pathogenic organisms likely to gain access to it. The test provides a check not only on the pasteurisation process but also on the post-pasteurisation addition of as small amounts of raw milk or cream as 0.2 per cent. of the total bulk.

The technique of the test, as described by Kay and Neave in the January 1937 issue of "Dairy Industries," was carefully followed in a series of over 300 milk samples obtained from two local pasteurising plants. It consists in subjecting a buffered solution of disodium phenyl phosphate to the action of a sample of milk for a definite temperature-time period, e.g., at 47°±2°C. for 10 minutes in test A and at 37 to 38°C. for 24° hours in test B. Phosphatase, if present in the milk, hydrolyses the phosphoric ester to an inorganic phosphate with the liberation of phenol, which is allowed to react with Folin and Ciocalteu's reagent giving a blue colour. The intensity of the blue colour is a measure of the phenol liberated and indirectly of the phosphatase contained in the milk.

In reading the results, the use of a simple comparator with standard Lovibond blue glasses was originally recommended. In my experience, the blue colours have a grayish hue and it is almost impossible to match them with the Lovibond blue glasses. That this difficulty was later recognized by Kay and Neave is apparent from a recommendation that low value red and yellow glasses are required in addition to the blue glasses to match the colours exactly.

Gilcreas and Davis(5) discarded the use of a tintometer and adopted as standards the blue colours produced by the interaction of Folin and Ciocalteu's reagent with measured amounts of phenol. The blue colours obtained in tests on milk samples were compared with these standards. From the

TABLE I

AVERAGE PHOTELOMETER READINGS OF 30 COMMERCIALLY PASTEURIZED MILK SAMPLES FROM REGULAR MILK OF DAIRY H OVER AN EIGHT MONTHS' PERIOD

TEST A

No. of Sample	Date of Test 1938	Photelometer Readings		
		Reagent Control	Past. Milk	Differences
7	11/1	83	74	9
13	14/1	84	72.5	11.5
34	2/2	82	72.5	9.5
77	6/4	87	70	17
101	27/5	81.75	72	9.75
105	6/6	77.5	66.25	11.25
109	7/6	77.5	64	13.5
113	8/6	80.5	68	12.5
117	13/6	74.5	60	14.5
122	14/6	81.75	61.25	20.5
127	15/6	81.75	57.75	24
131	20/6	81.5	65.5	16
137	22/6	81.5	67	14.5
145	27/6	84	69.25	14.75
149	28/6	84	74.5	9.5
153	29/6	85	74.5	10.5
161	4/7	83	68	15
165	6/7	80	70.5	9.5
169	12/7	83.75	66.5	17.25
172	13/7	84	66.5	17.5
176	18/7	86	66	20
180	20/7	83.5	67	16.5
184	25/7	78.5	59	19.5
188	28/7	80	66	14
192	8/8	81	68.5	12.5
196	10/8	80	70	10
200	15/8	80.5	70.5	10
203	17/8	81	69	12
207	22/8	82	69	13
211	24/8	81	65	16
Combined Averages		81.7	67.7	14

results of 30 samples of milk pasteurised in the laboratory at 143°F. for 30 minutes they determined that a phenol value of 0.037 mg. or less in a volume of 0.5 ml. produced a colour corresponding to that obtained by an efficiently pasteurised milk. In the present investigation a solution of pure phenol, 1 per cent. approximately, was prepared and when standardised according to Folin's(6) method, was found to be of such a strength that 1 ml. $\equiv$ 1.0308 mg.

phenol. Using this solution, dilutions were made so that 0.5 ml. amounts contained from 0.002 mg. to 0.618 mg. phenol in a graded series. It was found that the blue tints produced by quantities of phenol less than 0.01 mg. could not be satisfactorily distinguished by the eye, when viewed in tubes of 13 mm. diameter in the B.D.H. Lovibond Limitester*. From this graded series of blue tints some were selected for comparison with Lovibond blue glasses with the following results:

Blue colour produced by 0.5 ml. phenol solution equivalent to	Lovibond blue glass matched by phenol solution
0.021 mg.	1.5 units†
0.031 "	2.0 "
0.041 "	2.3 "
0.052 "	2.5 "
0.062 "	3.0 "
0.082 "	4.0 "
0.113 "	5.0 "
0.114 "	6.0 "
0.180 "	9.0 "

Control value corresponded to 0.004 mg. phenol

Unfortunately the phenol standards are not stable; if stored in the dark, they may be used for about 2 months but alterations soon occur vitiating the original graded series of blue colours. Gilcreas and Davis(7) attempted to overcome this difficulty by mixing appropriate quantities of cobalt chloride, copper sulphate and nickel sulphate in the preparation of blue-coloured inorganic solutions corresponding to phenol concentrations of 0.01, 0.02, 0.03, 0.04, 0.05, 0.06, 0.09, 0.12 and 0.15 mg. phenol.

Anderson, Herschdörfer and Neave(4) recommended the use of dyestuffs‡ Chlorazol Brown LFS, Chlorazol Fast Grey 2GS and Chlorazol Steel Blue 6BS for making standard solutions for colour comparison. In my hands neither the inorganic salts nor the dyestuffs resulted in blue colours comparable to those obtained in milk tests.

In recent years colorimeters and photometers have been introduced for the measurement of colour. Anderson, Herschdörfer, and Neave(4) reported results with the use of a Zeiss-Pulfrich photometer for the determination of colours obtained in test B by Kay and Graham's technique. The usual experience with such instruments is that the variations in the visual response among normal individuals are so great as to discourage their use. Colorimeters in which the eye of the observer is replaced by a photo-electric or photronic cell and a set of filters are now being constructed. The results reported in this article were obtained with the use of a Cenco-Sheard-Sanford photelometer(7). In this instrument an iris diaphragm is adjusted so that the light from a Mazda 50 C.P. bulb is received by a photronic cell and causes a deflec-

*Supplied by British Drug Houses Ltd.

†The intensity of colour is measured in Lovibond's method by an arbitrary unit determined by taking the smallest amount of colour easily perceptible to the ordinary vision. This unit is divided into tenths in the darker shades and into hundredths in the lighter shades. The unit is physiological and the exactitude of the coloured glass scales depends on the acuity of vision for appreciating small differences of colour. [Light and Colour Theories (1915) by J. W. Lovibond, E. & F. N. Spon, London, England.]

‡Obtainable from Canadian Industries Ltd., Montreal.

tion on the scale of a micro-ammeter when a cell containing the test fluid is placed between the source of light and the photronic cell. The selection of a suitable filter was aided by spectrophotometric curves (fig. 1) which show the spectral transmission† by (a) the blue colour obtained on a pasteurised milk sample, and (b) that obtained on a raw milk sample when phosphatase tests have been carried out. Both curves show an absorption zone with minimal transmission towards 680 millimicrons. Wratten filter No. 29F was chosen as it transmits light in maximal amount in this region where the phosphatase blue colours are absorptive. It is inserted directly in front of the photronic cell.

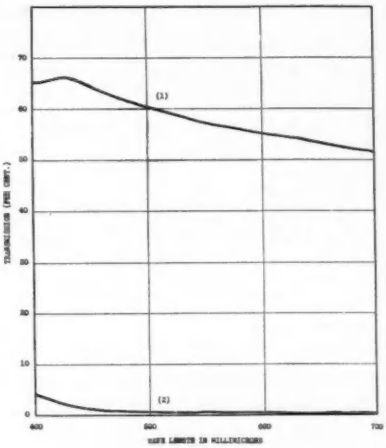


FIGURE I

Spectophotometric curves of blue colours obtained in the phosphatase test for (1) pasteurized milk and (2) raw milk.

In taking readings with the photelometer the micro-ammeter needle was brought to the 100 mark on the scale by adjusting the iris diaphragm when the central cell of the sliding carriage contained distilled water. Similar cells, one on either side of the central cell, contained the fluid from the phosphatase test, performed in duplicate. These cells were inserted in turn, readings taken and the average result recorded. Since the differences between the photelometer readings of the pasteurised milk controls and the pasteurised milk samples were so small, it was thought advisable to use the daily reagent controls as the standard of measurement and to record the differences of the pasteurised milk readings from them.

Kay and Neave(3) state that in test B the controls should either be carried through to completion within a few minutes as in test A or the filtrate, obtained in the stage after the addition of the diluted Folin and Ciocalteu's reagent, should be placed in the refrigerator till next day. A third procedure is to store the milk samples in the refrigerator for 24 hours and carry out controls on those samples showing a positive result on 24 hours' incubation. Tests by the three methods were performed in duplicate on 24 samples of pasteurised milk and on 26 samples of raw milk obtained from different sources. The average photelometer readings for pasteurised milk using the three methods in the above order were (1) 62.6, (2) 62.7 and (3) 62.5; for raw milk the readings were (1) 65.4, (2) 65 and (3) 65.4. The same results are obtained, therefore, whichever method is selected for the milk control tests.

Fifty samples of pasteurised milk taken from two local dairies at intervals during the course of a month were subjected to test A and readings taken with

†Chemical Spectroscopy (1939)—W. R. Brode (Wiley & Sons, Inc.)

and without the filter. As the differences between the readings were surprisingly constant—the range of variation being from 5.5 to 7.5 with an average reading of 6—there seemed no particular advantage in recording lower readings taken with the filter over those taken without the filter. The readings recorded in the tables are those taken without the use of a filter.

It must be realized that there is often considerable variation in the readings for individual milk samples, even after averaging the duplicate readings. This is illustrated in table I which shows the photelometer readings of 30 commercially pasteurised milk samples from the "regular" milk of dairy H. These "regular" milk samples were submitted to test A of the phosphatase

TABLE II

AVERAGE PHOTELOMETER READINGS OF COMMERCIALLY PASTEURIZED MILK SAMPLES FROM DAIRY H

TEST A

Source of Sample	No. of Samples	Date of Test 1938	Photelometer Readings		
			Reagent Control	Pasteurized Milk	Differences
Regular	30	11/1	81.7	67.7	14
Farm	30	to	81.7	69	12.7
Homogenised	30		81.7	68.2	13.5
Jersey	30	24/8	81.7	68.2	13.5
Combined Averages.			81.7	68.2	13.5
TEST B					
Regular	28	5/6	80.2	55.3	25
Farm	28	to	80.2	57	23.2
Homogenised	26		80.2	59.9	20.3
Jersey	26	14/9	80.2	59	21.2
Combined Averages.			80.2	57.8	22.4
CONTROLS					
Regular	30	27/5	81	66	15
Farm	30	to	81	66.4	14.6
Homogenised	30		81.3	64.8	16.5
Jersey	30	19/9	81	64.7	16.3
Combined Averages.			81.1	65.5	15.6

test in duplicate and the average of the photelometer readings recorded. The average readings for the reagent controls and for the pasteurised milk samples are shown for every day of the test over an eight months' period. There is a slight variation (74.5 to 84) in the reagent control readings, the average being 81.7, and also in the pasteurised milk readings (58 to 74), the average being 67.7. Similar variations in the results of tests A and B were found in the milk samples of the other designations. In spite of the individual variations, however, the averages show close agreement.

In tables II and III the results of tests A and B applied to milk samples from the two dairies, receiving milk from over 20 farms, are shown. In the case of dairy H "regular" milk is a bulked milk supplied from 20 small farms, each with an average herd of 22 cows; "farm" milk is milk from a model dairy farm supporting 300 to 400 head of cattle; and "Jersey" milk is obtained from two farms with about 35 head of cattle in all. This dairy supplies approxi-

mately 800 gallons of milk daily or 35 per cent. of the city's supply. In dairy P, vats Nos. 1 and 2 contain bulked milk from 26 small farms, each with an average herd of 12 cows. This dairy supplies approximately 500 gallons of milk daily or 20 per cent. of the city's supply.

COMMERCIALLY PASTEURISED MILK

The average photelometer-reading difference for 120 samples—30 each of regular, farm, homogenised and Jersey milk—of commercially pasteurised milk from dairy H using test A is 13.5. The corresponding figure for the same samples using test B is 22.4 and that for the pasteurised milk controls is 15.6. The deeper the blue colour the greater the photelometer-reading difference, so that the pasteurised milk controls are very slightly deeper in colour than the pasteurised milks of test A but lighter than those of test B.

TABLE III

AVERAGE PHOTELOMETER READINGS OF COMMERCIALLY PASTEURIZED MILK SAMPLES FROM DAIRY P

Source of Sample	No. of Samples	Date of Test 1938	Photelometer Readings		
			Reagent Control	Pasteurized Milk	Differences
TEST A					
Vat No. 1	16	7/1	83	71.8	11.3
Vat No. 2	16	to	83	71.6	11.4
Homogenised	16		83	72.5	10.5
Jersey	16	30/6	83	72.4	10.5
Combined Averages			83	72	11
TEST B					
Vat No. 1	5	23/6	79.2	57	22.2
Vat No. 2	5	to	79.2	60.3	19
Homogenised	5		79.2	60.4	18.7
Jersey	5	8/9	79.2	55	24.2
Combined Averages			79.2	58.2	21
CONTROLS					
Vat No. 1	10	24/3	81.4	67	14.4
Vat No. 2	10	to	81.4	67	14.4
Homogenised	10		81.4	67.9	13.5
Jersey	10	9/9	81.4	66.4	15
Combined Averages			81.4	67.1	14.3

For dairy P, the average photelometer-reading difference for 64 commercially pasteurised milk samples—16 each from vat No. 1, vat No. 2, homogenised and Jersey milk—to which test A was applied, is 11; for 20 similar milk samples to which test B was applied, 21, i.e., practically double the figure for test A; and for 40 similar milk samples as controls, 14.3. As in the case of dairy H, so for dairy P the pasteurised milk controls are slightly deeper than the pasteurised milk samples of test A but lighter than those of test B.

RAW MILK

Twenty samples of various types of raw milk from dairy H over a four months' period were subjected to test A with the following average photelometer readings:

Reagent Control	Raw Milk	Difference
83	2	81

Seventy raw milk samples obtained from dairy P over a five months' period gave exactly the same average results as for dairy H.

The average photelometer readings of 20 milk controls from raw milk samples of dairy P obtained over a two months' period were

Reagent Control	Raw Milk	Difference
79.6	64.8	14.8

The figure of 14.8 corresponds very closely with that of 14.3 obtained for the pasteurised milk controls of this dairy (cf. table III).

LABORATORY PASTEURISED MILK

According to Regulations pursuant to the Milk Control Act of Ontario, 1936, the minimum temperature for pasteurisation is 143°F., the milk being held at this temperature for at least 30 minutes. As most dairies tend to pasteurise milk at a slightly higher temperature, it was decided to obtain a series of raw milk samples from individual herds for laboratory pasteurisation. Ten ml. of each raw milk sample were pipetted into separate test-tubes which

TABLE IV

AVERAGE PHOTELOMETER READINGS OF 44 LABORATORY PASTEURISED MILK SAMPLES (143° F. FOR 30 MINS.)

TEST A

No. of Samples tested	Date of Test 1938	Average Photelometer Readings			Aver. diff. between R. Cont. &		Pre-heating time in mins.	Temp. Range in degs. C.	Aver. Temp. (30 min. readings)
		Reagent Control	Raw Milk	Past. Milk	Raw Milk	Past. Milk			
10	5/7	79.5	1.0	66.9	78.5	12.6	6	61.4–62	61.6
8	18/7	86	1.4	66.5	84.6	19.5	10	61.6–62.1	61.7
8	21/7	82.5	1.2	66.3	81.2	16.2	11	61.5–61.8	61.6
5	25/7	78.5	1.5	68.2	77	10.3	12	61.6–61.8	61.7
10	2/8	82	1.4	70.4	80.6	11.6	8	61.6–62.1	61.6
3	4/8	83.7	1	69	82.7	14.7	6	61.6–62.2	61.6
Combined Averages		82	1.25	68	80.8	14	9		61.6
TEST B									
10	6/7	78	0.6	56	77.4	22	6	61.4–62	61.6
8	19/7	85.2	0.8	54.3	84.4	31	10	61.6–62.1	61.7
8	22/7	81.2	0.8	57	80.4	24	11	61.5–61.8	61.6
5	26/7	79.2	0.8	54	78.4	25.2	12	61.6–61.8	61.7
10	3/8	81	0.7	53.8	80.3	27	8	61.6–62.1	61.6
3	5/8	84	0.7	54.7	83.3	29.3	6	61.6–62.2	61.6
Combined Averages		81.4	0.7	55	80.7	26.4	9		61.6

were then tightly corked. Another 10 ml. of one of the series of milk samples were pipetted into a similar test-tube, through the cork of which passed a standardised thermometer. The stem of the thermometer was immersed in the milk for 3 inches. All the test-tubes were then placed in a thermostatically controlled water bath at 61.6°C. (=143°F.). After allowing for the preheating time, the tubes were held as nearly as possible at this pasteuris-

ing temperature for 30 minutes. The thermometer readings were taken every minute to determine the variations; these were found to lie between ±0.5° from 61.6°C. Table IV shows the results of six experiments in which tests A and B were applied to each sample of the series in the raw state and after laboratory pasteurisation. For the total 44 samples to which test A was applied the average photelometer-reading difference between the reagent control and raw milk was 81 approximately and that between the reagent

TABLE V

SUMMARISED RESULTS OF RAW AND COMMERCIALLY AND LABORATORY PASTEURISED MILK SAMPLES

Milk designation	Dairy	Test	No. of samples	Average Photelometer Readings		
				Reagent Control	Milk	Differences
Commercially Past.	H	A	120	81.7	68.2	13.5
" "	H	B	108	80.2	57.8	22.4
Controls (Past.)	H		120	81.1	65.5	15.6
Commercially Past.	P	A	64	83	72	11
" "	P	B	20	79.2	58.2	21
Controls (Past.)	P		40	81.4	67.1	14.3
Raw	H	A	20	83	2	81
"	P	A	70	83	2	81
Controls (Raw)	P		20	79.6	64.8	14.8
Laboratory Past.	H	A	44	82	68	14
" "	H	B	44	81.4	55	26.4

control and pasteurised milk 14. Using test B the average photelometer-reading differences for raw milk and for pasteurised milk are approximately 81.5 and 26.5 respectively.

Table V summarises the results of raw and of commercially and laboratory pasteurised milk samples. It serves to compare the two dairies H and P. The controls both for pasteurised and raw milk samples are practically the same. Comparing the figures for test A, viz. 13.5, 11 and 14.2, and for test B, viz. 22.4, 21 and 26.5, it is concluded that dairy P is pasteurising milk at a temperature higher than that used by dairy H.

SUMMARY

The use of a photelometer to give a measure of the relative intensities of the blue colours, obtained when samples of raw and pasteurised milk are subjected to the Kay and Graham phosphatase test, is described. The photronic cell of the instrument acts as a sensitive mechanical eye and eliminates the sources of error and inaccuracy of the human eye of different observers. The photelometer is first adjusted to read a full-scale deflection (100 divisions) when a cell containing distilled water is inserted between the source of light and the photronic cell. Readings are then taken by introducing the blue coloured solutions contained in spectroscopic absorption cells into the sliding carriage of the photelometer. It has been found convenient to use the reagent control as the standard of reference and to record the photelometer-reading differences for milk samples and controls.

ACKNOWLEDGMENTS

The photelometer, used in reading the results of the tests, was kindly loaned by the Central Scientific Company (Canada) Limited, Toronto. Mr. T. W. McParland, who was engaged under a grant from the Science Research Committee of Queen's University, assisted in the investigation.

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The Lengthening of the Reduction Time in Milk with the New Standard Methylene Blue Solution*

C. K. JOHNS, B.S.A., M.Sc., Ph.D.†

IN 1935, Thornton and Sandin (10) recommended that methylene blue thiocyanate should replace the chloride previously employed in the methylene blue reduction test, and that the concentration of the dye in milk be increased from 1: 700,000 to 1: 300,000.‡ These recommendations have been accepted and incorporated in the 7th edition of Standard Methods for the Examination of Dairy Products, published by the American Public Health Association (1).

Although equivalent concentrations of these two salts gave identical results, Thornton and Sandin reported an average lengthening of reduction time for all classes of milk of approximately 30 minutes with the stronger concentration of dye (1: 300,000). On the other hand, Johns (7, 8) found the increase to be proportional to the reduction time, averaging around 20 per cent. for all classes of milk, while Frayer (4) reported that the reduction time was practically doubled with the stronger concentration.

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†Associate Bacteriologist.

‡Although it was intended that the standardized tablets should furnish the dye concentration in milk (1:300,000) originally recommended by Barthel and Orla-Jensen, it has been shown (Conn, Am. J. Pub. Health, 1937, 27:793-795) that the concentration actually obtained with the chloride was close to 1:700,000.

The results reported by Frayer are difficult to account for. The discrepancy in the findings of Thornton and Sandin and of Johns is more susceptible of explanation on the basis of seasonal differences in flora, since the Edmonton workers employed summer milks while winter milks were studied at Ottawa. To throw further light upon the subject, a further series of comparisons was made at Ottawa with summer milks, while redox potential studies were made upon a number of milks containing the old and new dye solutions.

METHODS

Solutions of the old standard methylene blue chloride (1: 700,000) and of the new methylene blue thiocyanate (1: 300,000) were prepared from the standard tablets. In both potentiometric and visual reduction studies, the error resulting from creaming (4, 7, 8, 9, 13) was minimized by hourly inversion of the tubes until incipient reduction was noted; during subsequent incubation they remained undisturbed. Readings were taken at 15-minute intervals.

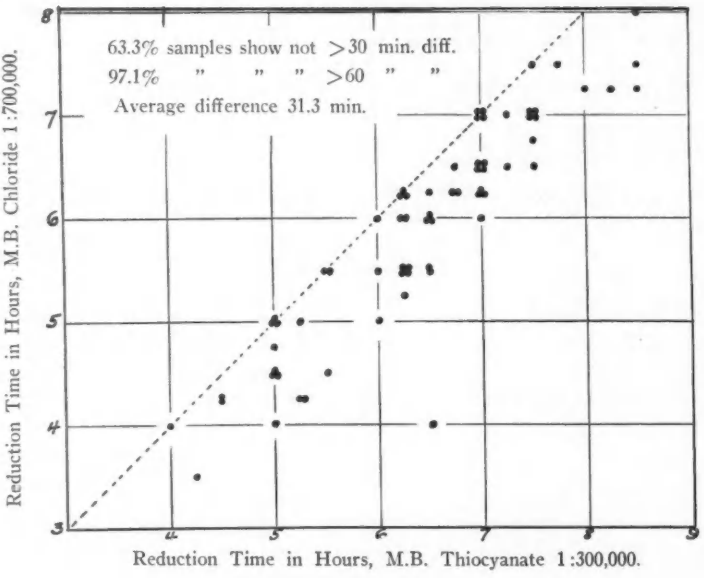

FIGURE I
Corresponding Reduction Times with Old and New Standard Methylene Blue Solutions (68 samples, July, 1939).

Redox potentials were determined on 27.5 ml. portions of milk plus dye in 1″ x 8″ test tubes, each tube carrying two coiled platinum-wire electrodes. The platinum coils were placed in the centre of the column of milk about 35 mm. below the surface. Duplicate tubes for each dye concentration were immersed in a thermostatically controlled water-bath running at 37°±0.5°, and connections made to a Model G Beckman potentiometer through a 12-way switch.

RESULTS

Fig. I shows the corresponding reduction times with the old and new dye solutions for 68 samples of summer milk. In fig. II are shown the potential-time curves for plain milk, milk plus methylene blue chloride (1:700,000) and milk plus methylene blue thiocyanate (1:300,000). These are fairly typical of those obtained with a number of other samples. The points on the curves for both dye-milk mixtures represent the average of four different electrodes; those for the plain milk, two electrodes.

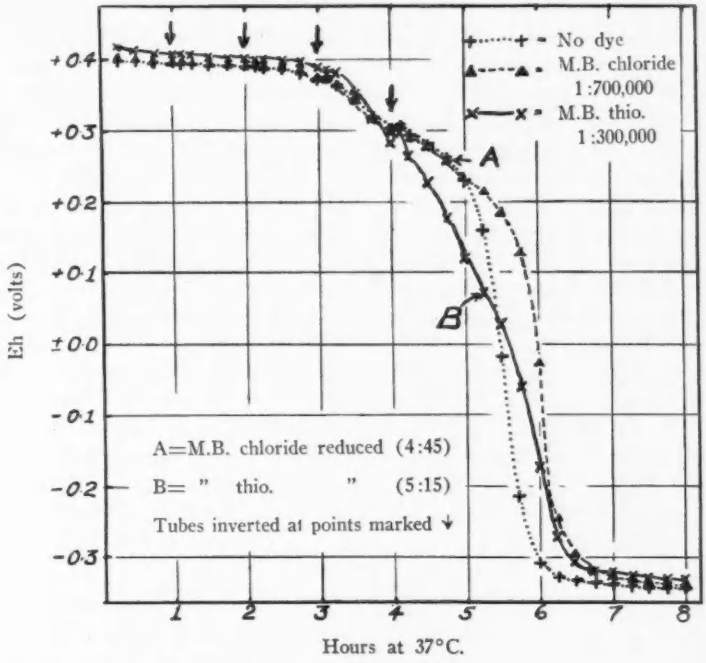

FIGURE II
Potential-Time Curves for Milk with and without Methylene Blue Solutions.

DISCUSSION

The stronger thiocyanate solution invariably causes a slightly earlier fall in potential, as depicted in fig. II. If visual reduction took place over the same approximate Eh range as with the weaker chloride solution, as reported by Thornton, Sandin and Miller (11), the thiocyanate should reduce slightly earlier than the chloride. However, we have invariably found the potential at which the stronger thiocyanate solution was decolorized was significantly (sometimes as much as 200 m.v.) lower than that noted for the chloride solution. This is in accord with the findings of Fay and Aikins (3) on the influence of dye concentration upon the zone of decolorization, and explains

the slight lengthening of reduction time with the stronger thiocyanate solution.

The difference between the reduction times for the two different strengths of dye solution will obviously depend upon the slope of the potential-time curve. Where this is steep, only a short interval will elapse after passing through the zone of decolorization of the weaker dye solution before the potential drops to the zone of decolorization of the stronger. On the other hand, as Fay and Aikins report, milks held for some time at a low temperature show a much slower fall in potential. Johns (8) found the delaying influence of the stronger dye solution practically twice as great where replicate tubes were given a preliminary incubation at 12.8°C. for 18 hours. In potentiometric studies with winter milks we have encountered a number which displayed this phenomenon, often taking well over an hour to drop 100 m.v. in the region of the zone of decolorization of the thiocyanate. This phenomenon, which appeared to be most pronounced with the better grades of milk, affords a reasonable explanation for the wider differences in reduction time noted with the old and new dye solutions for winter milks (7, 8).

In the light of these studies, it is very difficult to understand the greatly delayed reduction reported by Frayer (4) for the stronger thiocyanate solution.

Most workers have reported positive Eh limits between +0.2 and +0.3 v., and negative limits approximating Eh −0.2 v. (2, 3, 5, 9). Nearly all of the milks we have studied have shown initial potentials approaching +0.4 v. and with the majority the negative limits have approximated −0.35 v. Wilson (13) and Hobbs (6) have reported values similar to ours for pure cultures of coliform organisms while Webb and Hileman (12) give initial potentials of +0.32 to +0.35 v. for market milks. The fact that milks inoculated with butter culture have shown the usual limiting negative potential of approximately −0.2 v. suggests that the flora of the milks which we have been studying is quite different from those encountered by other workers.

SUMMARY

The average increase in reduction time using the new methylene blue solution (thiocyanate 1:300,000) for summer milks is around 30 minutes. The greater increase previously reported appears to be due to the slower drop in potential noted for many samples of winter milks.

The slower reduction with the new dye concentration appears to be due to the lower potential at which the dye-milk mixture decolorizes.

ACKNOWLEDGMENT

The assistance of Mr. R. K. Howson, B.S.A., in connection with these studies is gratefully acknowledged.

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A Modified Apparatus for the Gutzeit Test for Arsenic*

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APPARATUS

THE apparatus used is shown in figure I and is a modification of a Gutzeit apparatus of Pyrex glass with interchangeable glass joints made by the Scientific Glass Apparatus Company, Bloomfield, N.J. The modification consists in replacing the top tube with a condenser as suggested by

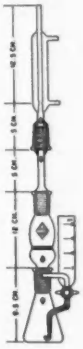

FIGURE I

The apparatus stands 44 cm. (approximately 17 inches) high.

Crossley (1936). The original apparatus was an experimental model designed by Dr. E. W. Wallace, University of Cincinnati, as an improvement on Lachele's method (1934).

The small Erlenmeyer-shaped flask with a total capacity of 50 ml. possesses a side funnel of 20 ml. capacity and a vertical delivery tube in three sections. The first or *lower* section contains a fritted disc to remove acid spray from the gases, and above it rests a little glass wool impregnated with

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lead acetate; the second or *middle* section consists of a narrow tube in which a piece of filter paper previously impregnated with lead acetate is placed; while the third or *upper* section is a small condenser, the inner tube of which is only slightly wider than the sensitised paper strip to be used, with a constriction on which the strip rests.

By observing carefully the subsequent details, arsine is evolved at the same rate from day to day and the stains produced may confidently be regarded as comparative. A duplicate apparatus of the same type has given identical results for small amounts of arsenic, 0.001 mg. to 0.02 mg. arsenic as arsenious oxide.

It is important that the mixture in the generating flask should be standardised, since the rate of gas evolution is influenced by the volume in the flask, the temperature of the mixture, the type of acid used and the presence of sensitising agents.

For the small amounts of arsenic taken, the volume of fluid should not exceed 25 ml.

The optimum temperature for hydrogen-arsine generation appears to be 20°C.

Hydrochloric acid is used instead of sulphuric acid because the action is more uniform and there is less likelihood of hydrogen sulphide being formed.

Stannous chloride effects a more uniform and complete evolution of arsine, reducing pentavalent arsenic compounds to the trivalent form. The presence of an iron salt is said to inhibit the evolution of stibine.

The cold water condenser in which the sensitised paper is inserted serves to keep as uniform as possible the temperature and humidity of the arsine in its reaction with the mercuric bromide paper.

REAGENTS AND MATERIALS REQUIRED

Hydrochloric acid: Concentrated and arsenic-free. Other reagents must likewise be arsenic-free.

Zinc shot: 3 to 6 inch mesh, treated with dilute HCl until surface clean and and dull, kept covered with distilled water. The size of the shot is not very important provided the same size is always used. It is an advantage to use shot presenting the same area of surface for attack, as this favours a steady and reproducible rate of hydrogen generation.

Ferric Alum Solution: 8.4 gm. of $Fe_2(SO_4)_3.(NH_4)_2SO_4.24H_2O$, dissolved in water containing 1 gm. NaCl and 2 ml. H_2SO_4 diluted to 100 ml.

Stannous Chloride Solution: 8 gm. of $SnCl_2.2H_2O$ dissolved in 10 ml. water containing 0.5 ml. HCl.

Lead Acetate paper: Pieces of Whatman No. 1 filter paper 4 cm. square are soaked in a 1 per cent. aqueous solution of $Pb(C_2H_3O_2)_2.3H_2O$ and allowed to dry thoroughly overnight.

"Sensitized" test paper (mercuric bromide): Strips of Whatman No. 2 filter paper are cut 4 mm. x 140 mm. and immersed without previous drying in 1.5 per cent. $HgBr_2$ dissolved in 95 per cent. alcohol. The strips are dried in the air for 2-3 minutes and inserted in the condenser tube when the test is ready to be performed. The mercuric bromide solution should be freshly

prepared daily. It is preferable to the chloride as the stains are deeper in shade and somewhat easier to read.

PREPARATION OF STANDARD SOLUTION OF ARSENIOUS OXIDE (As_2O_3)

Method: A standard sample of arsenious oxide, As_2O_3, was obtained from the Bureau of Standards, Washington, D.C., bearing a certificate of 99.97 per cent. purity. The sample was resublimed, however, before being used in the preparation of a standard solution.

Stock Solution: Since $As_2 : As_2O_3 :: 1 : 1.3204$, therefore 1.3204 gm. of resublimed arsenious oxide were dissolved in 25 ml. of 20 per cent. NaOH solution and neutralized with dilute H_2SO_4. The solution was diluted with fresh distilled water, acidulated with 10 ml. of concentrated H_2SO_4, to a volume of 1000 ml. and constitutes the stock solution. It contains 1 mg. arsenic as As_2O_3 or 1000 γ As in 1 ml.

Arsenious oxide dissolves very slowly in water but readily in sodium hydroxide. In an alkaline solution, arsenious oxide is slowly oxidized to arsenic oxide, therefore the solution is made slightly acid so as to render it stable for a long period of time.

Solution A: 10 ml. of the stock solution are diluted to 100 ml. with acidulated distilled water as above. This solution contains 0.1 mg. arsenic as As_2O_3 or 100 γ As in 1 ml.

Solution B: 1 ml. of solution A is diluted to 100 ml. with acidulated distilled water. This solution contains 0.001 mg. arsenic as As_2O_3 or 1 γ As in 1 ml.

PREPARATION OF STANDARD STAINS

A series of standard stains is prepared by introducing into the Gutzeit flask arsenic solution B in amounts of 1, 2, 4, 6, 8 and 10 ml. respectively, measured from a burette. The range may be extended conveniently up to 20 ml. Distilled water is added to the flask until the volume is 20 ml.

One ml. of ferric alum solution, 0.25 ml. of stannous chloride solution and 10 gm. zinc shot, approximately 25 pieces, are now added.

The flask is immersed almost up to the neck in a water bath at 19°C. for 10 minutes.

During this interval a gallon jar is filled with water at 20°C. and connected to the condenser so as to keep the temperature and humidity as constant as possible.

The sensitized test-paper is placed in the condenser, the lower end resting on the constriction.

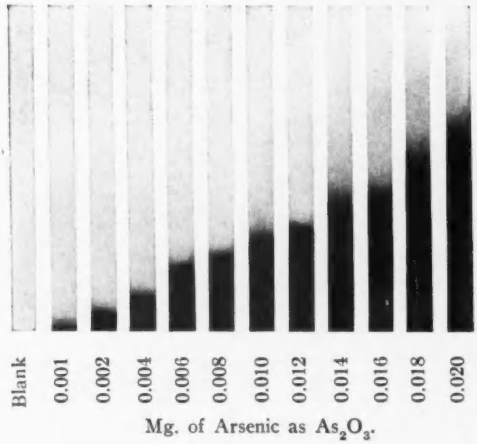
Four and one-half ml. of concentrated HCl are measured into the funnel and amounts of 1, 1.5 and 2 ml. allowed to run slowly into the flask at 5-minute intervals. The test is allowed to run for 30 minutes more after the last addition of the acid.

As moisture and light have a deteriorating effect on the intensity of the stains, it is advantageous to preserve the stains by dipping the papers in parowax kept molten over boiling water. The strips may be mounted on a piece of thin white cardboard with the lower edges of the stains in alignment and covered with a sheet of wax (grease-proof) paper.

When a test is carried out on an unknown material, the length of the stain is compared with those obtained with the standard solutions and an estimation made of the quantity of arsenic present.

FIGURE II

The Gutzeit Test for Arsenic.
Standard Stains.



APPLICATIONS

The modified apparatus has been used for the determination of small amounts of arsenic in water, in samples of hair and in pulverized rock materials.

The procedure adopted for rock samples is essentially the same as in Scott's Standard Methods of Chemical Analysis. It consists in treating 2.5 gm. of finely powdered rock with 5 ml. of a mixture of 2 parts liquid bromine and 3 parts of carbon tetrachloride. This is allowed to act for 15 minutes with frequent shaking to promote thorough oxidation. Ten ml. of concentrated HNO_3 are now added and the mixture evaporated slowly to dryness. On cooling, 5 ml. of concentrated H_2SO_4 are added and heated until SO_2 fumes are evolved to expel the nitric acid. The cooled sample is now extracted with 6 ml. of distilled water, warmed gently for 3 to 5 minutes and poured into a centrifuge tube. Another 4 ml. of distilled water are used to wash into the centrifuge tube. After centrifuging, the supernatant fluid is decanted into the generating flask. This constitutes the test fluid.

Experiments have shown that better results are obtained by this extraction than by using a powdered rock sample weighed directly into the generating flask.

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